Shri Ramdeobaba College of Engineering and Management, Nagpur-13.
Department of Electronics Engineering
Analog and Digital Communication Engineering Lab [ENP357]

Even Semester – 2023-24

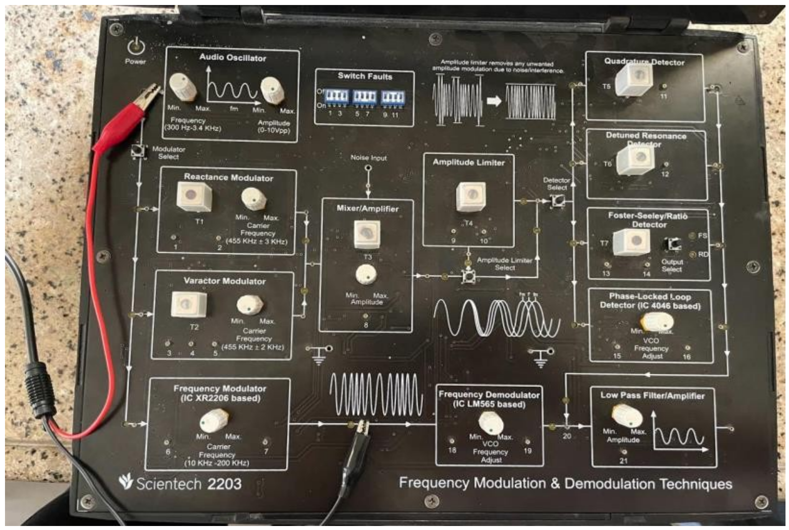
Lab 02

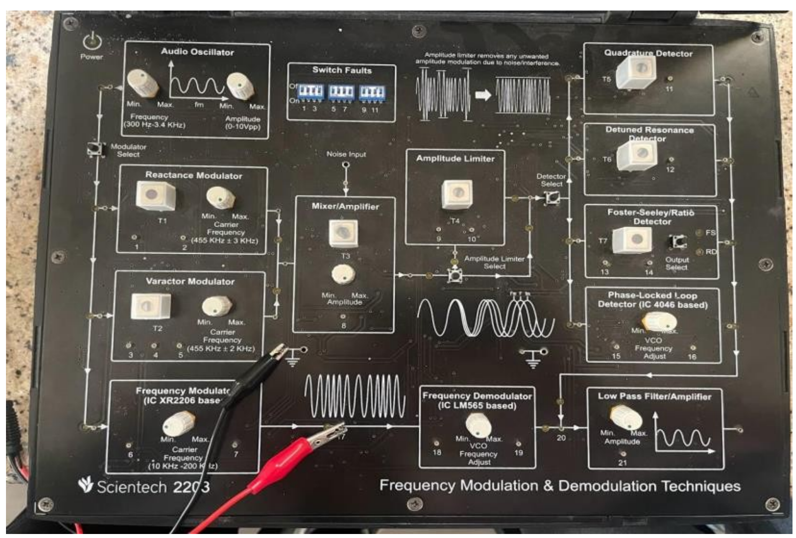
Frequency Modulation

Name:	Pawan Dilip Sorte
Batch / Roll No. :	A1/12
Semester/Section:	6^{th} /A
Date of Performance:	23/1/2024
Date of Submission:	17/04/2024
Name & Signature of Faculty:	Mrs.Rohini Ochawar

Lab-02

1. **Aim:** Transmission and Reception of an audio signal using Frequency Modulation / Demodulation Technique and computation of modulation index of FM waveform.
2. **Tool Required:** Frequency modulation and demodulation kit [VCO].
3. **Circuit Diagram:**





4. Observation Table:

Table No. 1: Calculation of Modulation Index M_f

Case	Amplitude of Message Signal(V)	Frequency of Message Signal(Hz)	Frequency Deviation(δ) in Hz	Modulation Index M_f
1	3V	3 KHz	52 KHz	15.75
2	2.6V	1.9 KHz	7.7 KHz	4.05
3	3V	1.1 KHz	-	-

5. Calculations:

- Modulation Index, MI = ∂/f_m
- $\partial = \frac{fmax - fmin}{2}$
- T_{clk} = (F_{max} scale) x (time/div)
- $F_{max} = 1/T_{clk}$

Modulation:

1. f_m = 3 KHz

   Time = 0.1ms x 3

   $f_m = \frac{1}{3 \times 0.1 \times 10^{-3}}$

   f_m = 3 KHz

   $$f_{min} = \frac{1}{6.4 \times 5 \times 10^{-6}} = 312 \text{ KHz}$$

   $$f_{max} = \frac{1}{4.8 \times 5 \times 10^{-6}} = 416 \text{ KHz}$$

   $$\partial = \frac{fmax - fmin}{2}$$

   $$= \frac{416 - 312}{2}$$

   = **52 KHz**

MI = $\frac{\square}{\square}$

$= \frac{52}{3.3}$

$= \mathbf{15.75}$

2. f_m = 1.9 KHz

   Time = 0.2ms x 2.6

   $f_m = \frac{1}{2.6 \times 0.2 \times 10^{-3}}$

   f_m = 1.9 KHz

   $f_{min} = \frac{1}{4.6 \times 5 \times 10^{-6}} = 43.4$ KHz

   $f_{max} = \frac{1}{3.4 \times 5 \times 10^{-6}} = 58.8$ KHz

   $\partial = \frac{f max - f min}{2}$

   $= \frac{58.8 - 43.4}{2}$

   $= \mathbf{7.7\ KHz}$

   MI $= \frac{\square}{\square}$

   $= \frac{7.7}{1.9}$

   $= \mathbf{4.05}$

Demodulation:

T = 3 x 0.3 ms

= 0.9 ms

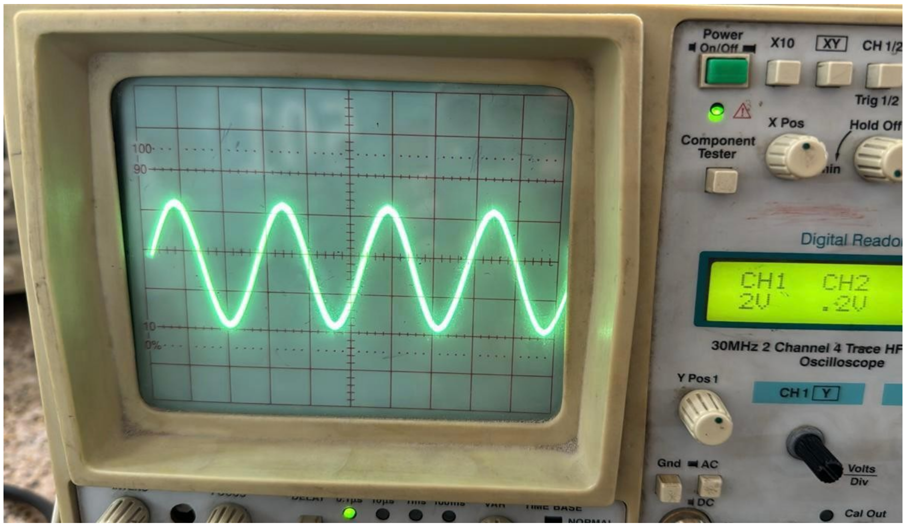
F = 1/T

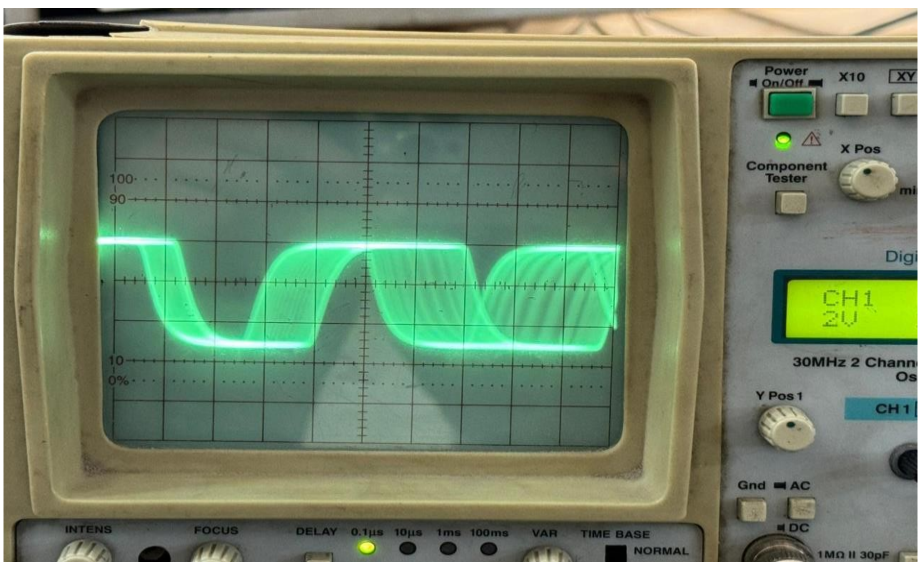
= 1/0.9ms

= 1.1 KHz

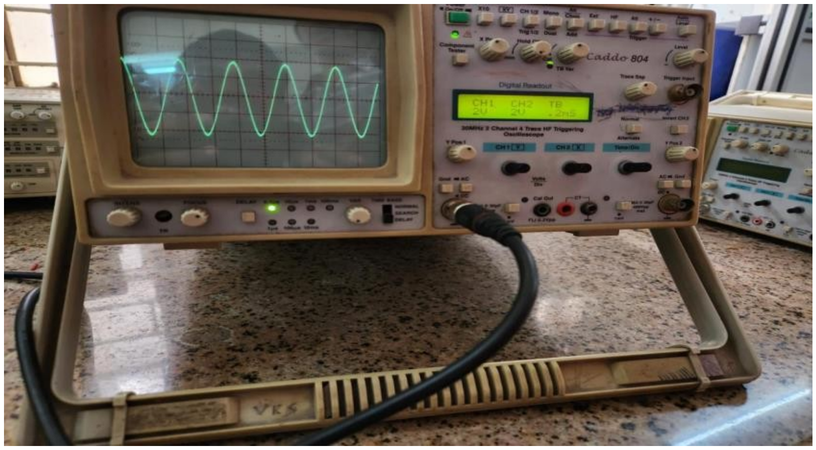
6. Obtained Waveforms/Simulation Results:

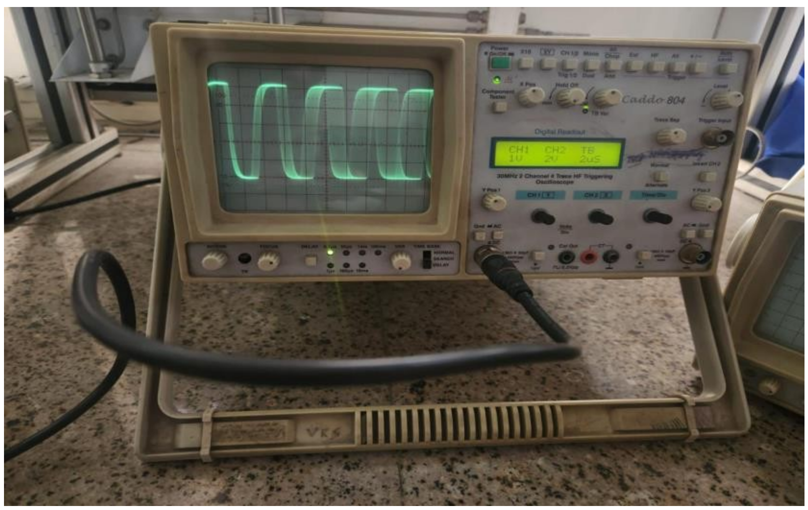
1. f_m = 3 KHz



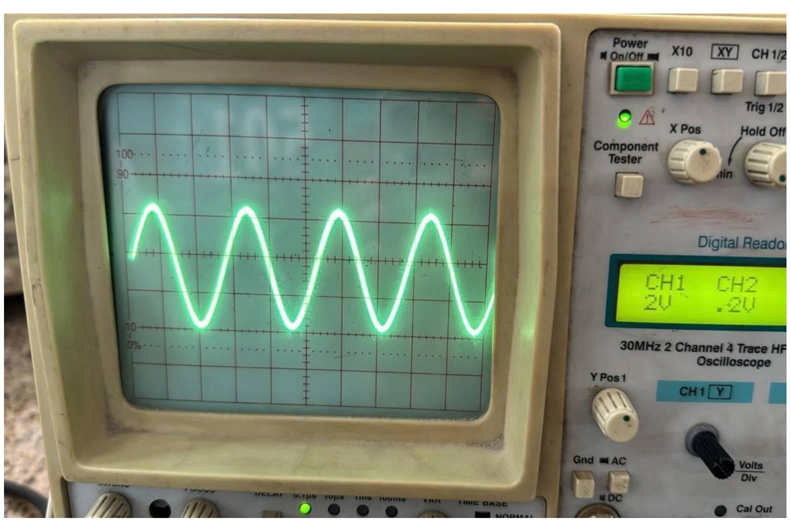


2. f_m = 1.9KHz





3. Demodulation:



7. Discussion and Conclusion:

1) For first set of reading MI = 15.75 kHz

2) For second set of reading MI = 4.05 kHz

In radio transmission, frequency modulation has a good advantage over other modulations. It has a larger signal-to-noise ratio meaning it will reject radio frequency interference much better than an equal power amplitude modulation (AM) signal.

The frequency modulation & demodulation of the signal for Narrowband & wideband F are observed. We can vary frequency by varying inductive reactance or capacitive reactance. The modulation index is higher for the fm = 3KHz compared to the fm = 1.9 KHz. This difference suggests a greater degree of signal modulation in the second set, potentially influencing factors such as signal clarity, bandwidth usage, and transmission efficiency.