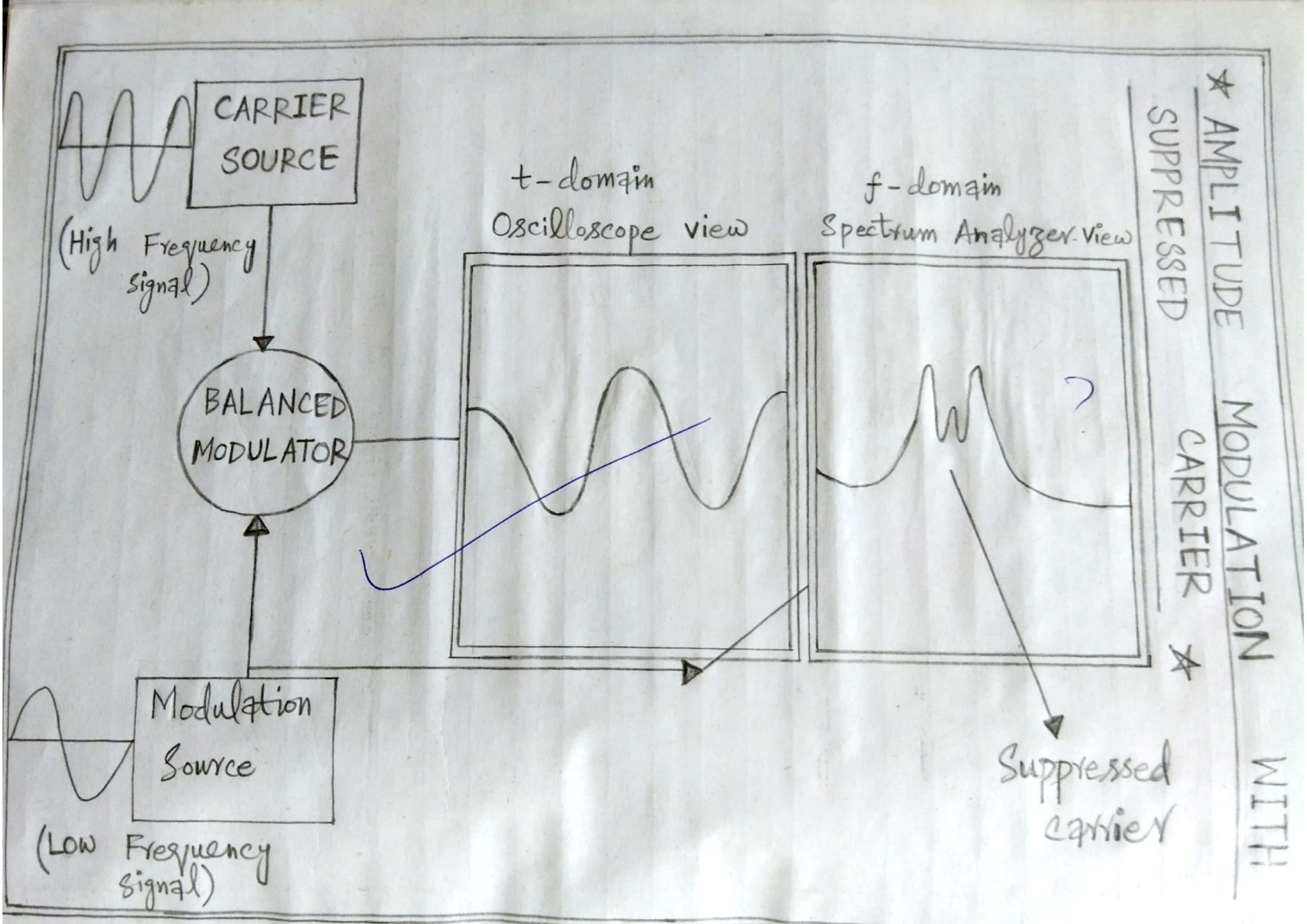
★ AMPLITUDE MODULATION WITH SUPPRESSED CARRIER ★



EXPERIMENT No : 01

☆ AMPLITUDE MODULATION WITH SUPPRESSED CARRIER ☆

THEORY :-

AMPLITUDE MODULATION :-

"If the amplitude of the carrier signal is changed w.r.t message signal, modulation is called Amplitude Modulation, keep frequency and phase constant."

Amplitude Modulation is also called "Linear Modulation."

DOUBLE-SIDEBAND SUPPRESSED CARRIER (DSB-SC) :-

"Double-sideband suppressed-carrier transmission is a transmission in which frequencies produced by amplitude modulation are symmetrically

spaced above and below the carrier frequency and the carrier level is reduced to the lowest practical level, ideally being completely suppressed."

REQUIREMENTS :-

i) Carrier Signal.
ii) Modulating / Message Signal.
iii) Modulated Signal.

APPARATUS :-

i) Amplitude Modulation Kit (S3.130).
ii) Data Equisition System RAT (S3.100).
iii) PC with feedback discovery software and oscilloscope.

PROCEDURE :-

i) Start the 'Discovery Software'.
ii) Set the carrier level to maximum.
iii) Set the modulation level to zero.
iv) Note the signals of all

monitoring points.

(v) Now, increase the modulation level and observe at 6.

(vi) Increase the Modulation level ML until the carrier amplitude reaches to zero.

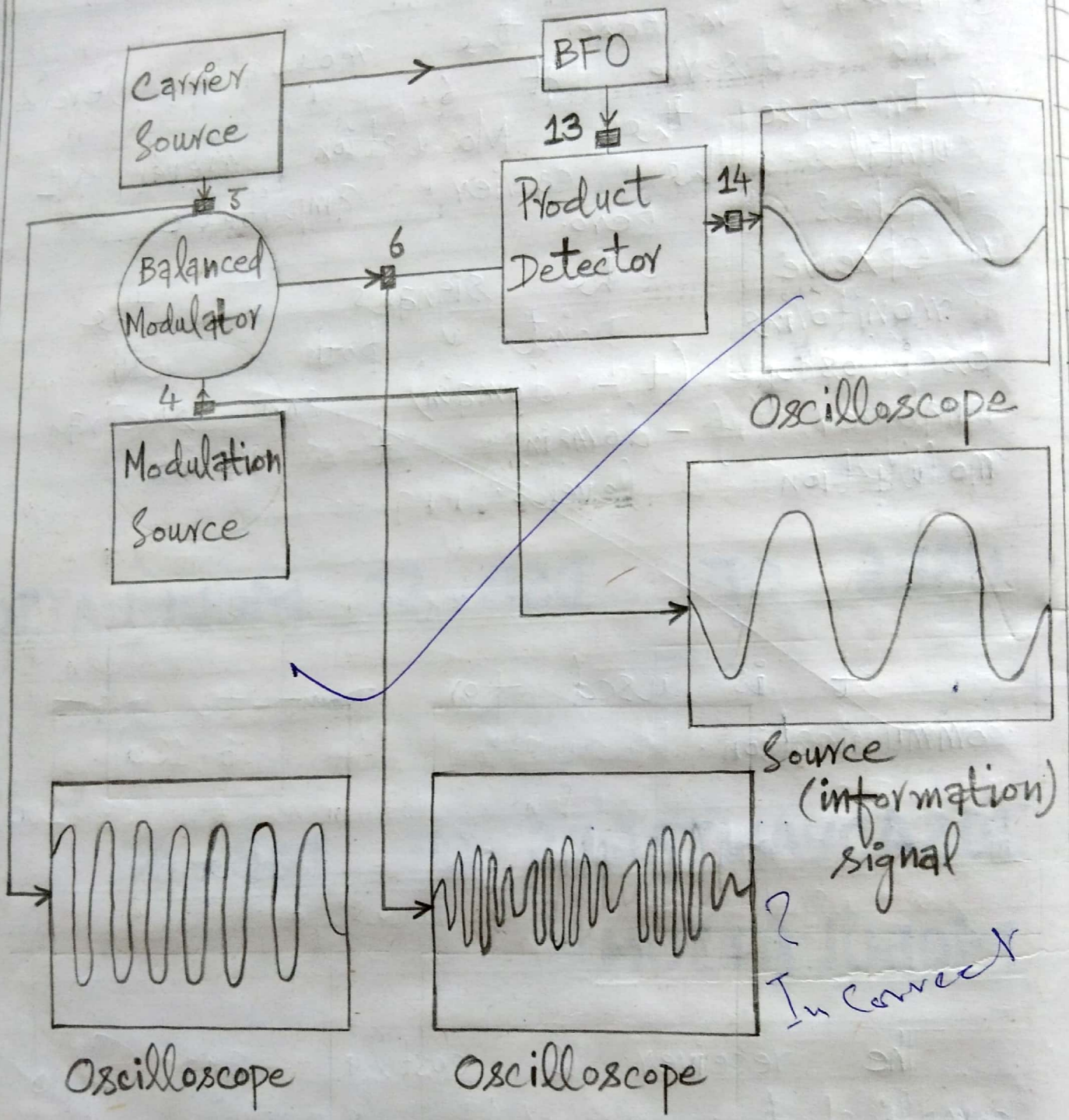
(vii) Observe the signals of the monitoring points both with oscilloscope (t - domain) and spectral analyzer (f - domain) at various modulation levels.

USES OF DSB-SC MODULATION:

It is used for point-to-point communication.

DISADVANTAGES OF DSB-SC MODULATION:-

The receiver is costly and complicated.



Block Diagram of Product detector Demodulation

EXPERIMENT NO : 02

☆ DEMODULATION OF SUPPRESSED CARRIER USING PRODUCT DETECTOR ☆

THEORY :-

DE-MODULATION :-

"The process of recovering the signal from the modulated signal (retranslating the spectrum to its original position) is referred to as demodulation or detection." For demodulation, another carrier signal is generated at the receiver's end having same frequency and phase as input carrier signal.

REQUIREMENTS :-

i) Carrier Source.
ii) Modulation Source.
iii) Modulator.

iv) Product Detector.
v) Beat Frequency Oscillator (BFO).

APPARATUS :-

i) AM Kit (S3-130).
ii) DAQ- RAT (S3-100).
iii) PC with the Discovery software.
iv) Oscilloscope.

PROCEDURE :-

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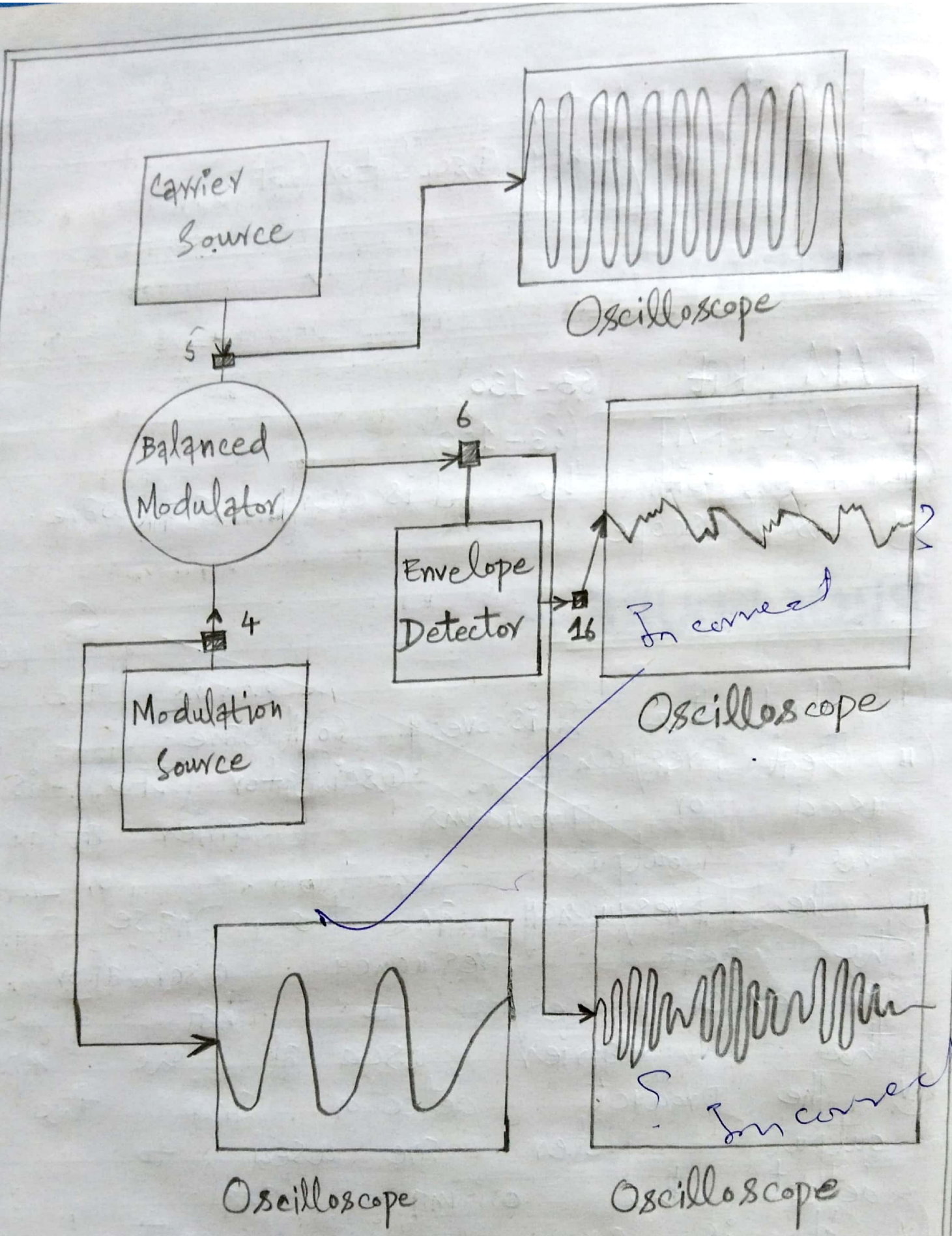
i) Start the 'Discovery software'.
ii) Beat Frequency Oscillator (BFO) is used for providing carrier at the output.
iii) The frequency and the phase of the Beat Frequency oscillator is exactly equal to that of the carrier used at the input.
iv) The product detector and the output filter are used to detect the original signal.
v) It is a difficult method, therefore, it is used rarely.



EXPERIMENT No: 03

★ DEMODULATION OF DSB-SC USING ENVELOPE DETECTOR ★

THEORY :-

ENVELOPE DETECTOR :-

"An envelope detector is an electronic circuit that takes a high-frequency amplitude modulated signal as input and provides an output which is the envelope of the original signal."

REQUIREMENTS :-

(i) Carrier Source.
(ii) Modulation Source.
(iii) Balanced Modulator.
(iv) Envelope Detector.

APPARATUS :-

(i) Amplitude Modulation Kit (33-100).

ii) Data Equisition System RAT (53-100).
iii) PC with feedback Discovery Software.
iv) Oscilloscope.

PROCEDURE :-

i) Start the 'Discovery' software.
ii) Go to the system → Index → Amplitude Modulation.
iii) Select 'Yes' to load the assignment.
iv) Start the practical.
v) Set the modulation to 100% by adjusting the modulation index.
vi) Observe the signals of the monitoring points both with oscilloscope (t-domain) and spectral analyzer (f-domain).

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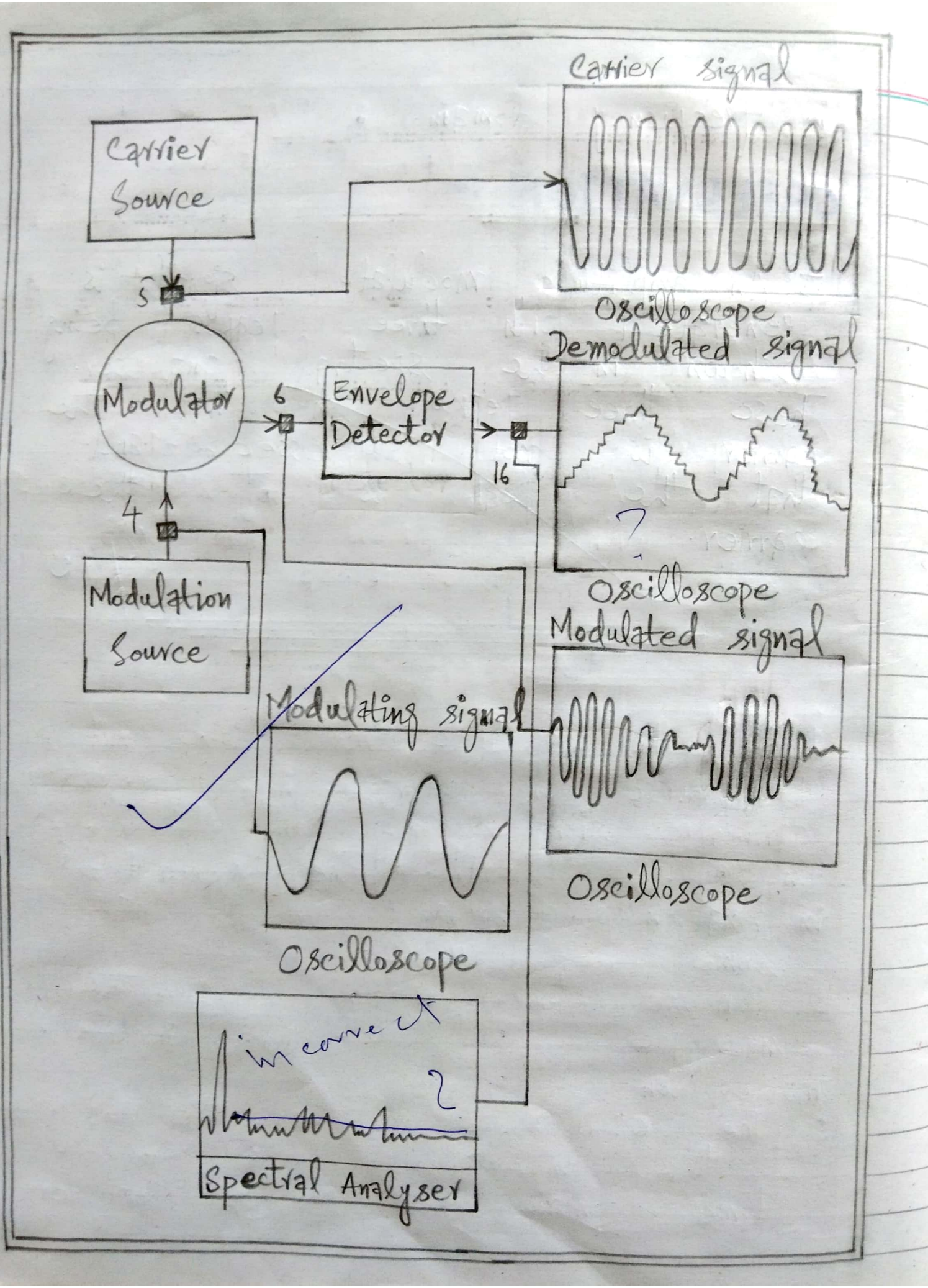

EXPERIMENT NO : 05

★ DEMODULATION OF FULL-CARRIER MODULATED SIGNAL USING ENVELOPE DETECTOR ★

APPARATUS :-

1. Amplitude modulation kit (S3-100).
2. Data Acquisition System RAT (S3-100).
3. PC with feedback discovery software oscilloscope.

PROCEDURE :-

1. Load the assignment.
2. There are two types of demodulation. choose the envelope detection.
3. The modulated signal is demodulated and a signal almost similar to the modulating signal is obtained at the recieving end.

OBSERVATION :-

Successful demodulation is done using envelope detector demodulation. Signal is further passed the filter in order to acquire smooth waveform of the demodulated signal.

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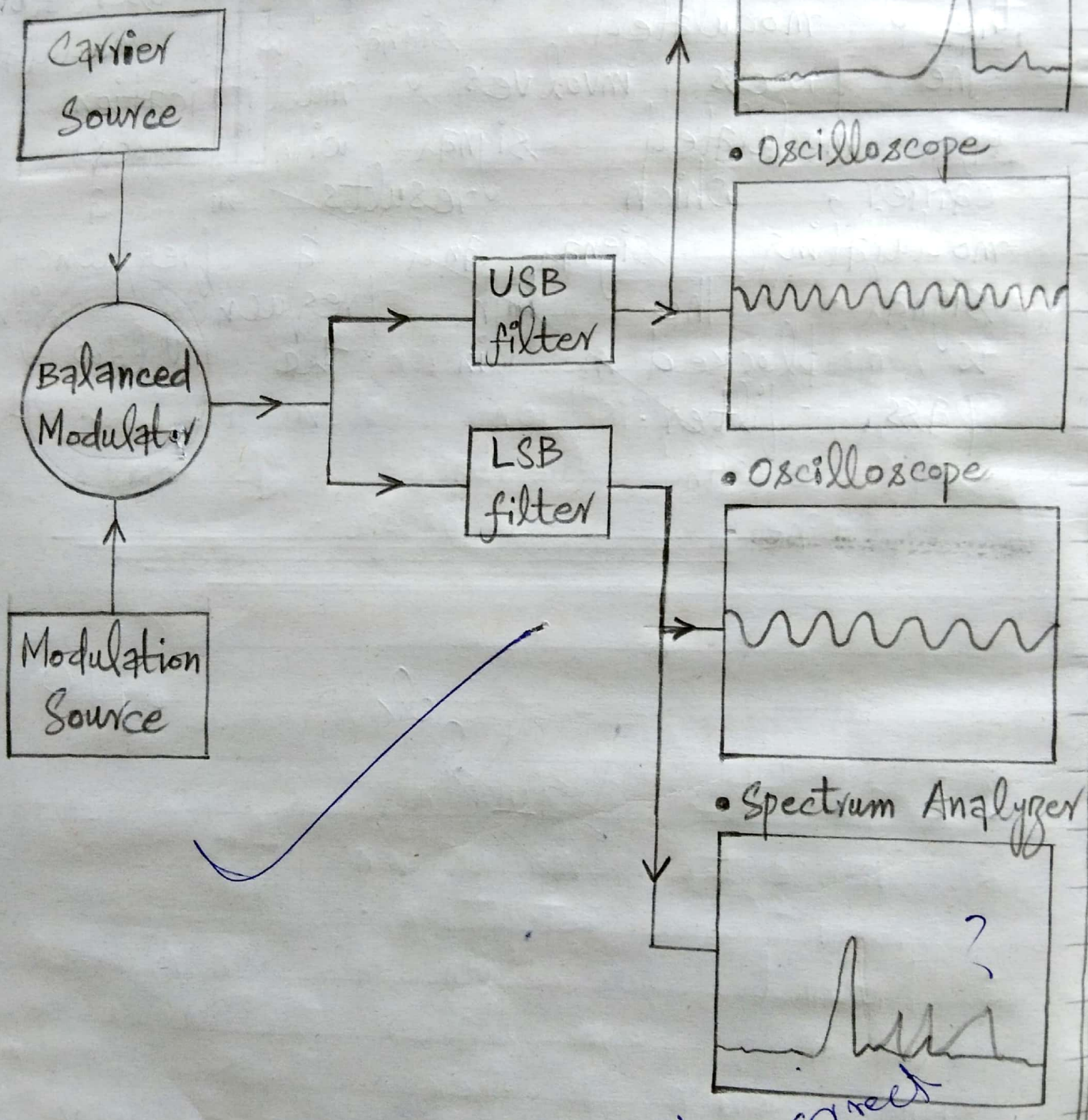
⇨ Generation of SSB - Signal



EXPERIMENT No : 07

★ GENERATION OF SINGLE-SIDE BAND ★

APPARATUS :-

1. Amplitude Modulation Kit (S3-130).
2. Data Acquisition System RAT (S3-100).
3. PC with feedback discovery software oscilloscope.

THEORY :-

➪ Single-Side Band Modulation :-

In single-side band modulation, only one side band is transmitted instead of (2) or double-band. As both side-bands 'LSB' and 'USB' contains the same information, so in order to preserve the bandwidth, only one side-band is transmitted and other is suppressed.

⇨ Generation of Single-side band :-

Three methods are commonly used to generate SSB-signal.

- → Phase-shifting.
- → Selective filtering.
- → Weaver Method.

In this experiment, we use filtering method to generate SSB-signal.

PROCEDURE :-

1. Start the discovery software.
2. Go to the system → Index → select the required category.
3. Start Yes to load the practical.
4. Observe the signal at monitoring points both with oscilloscope and spectrum analyzer.

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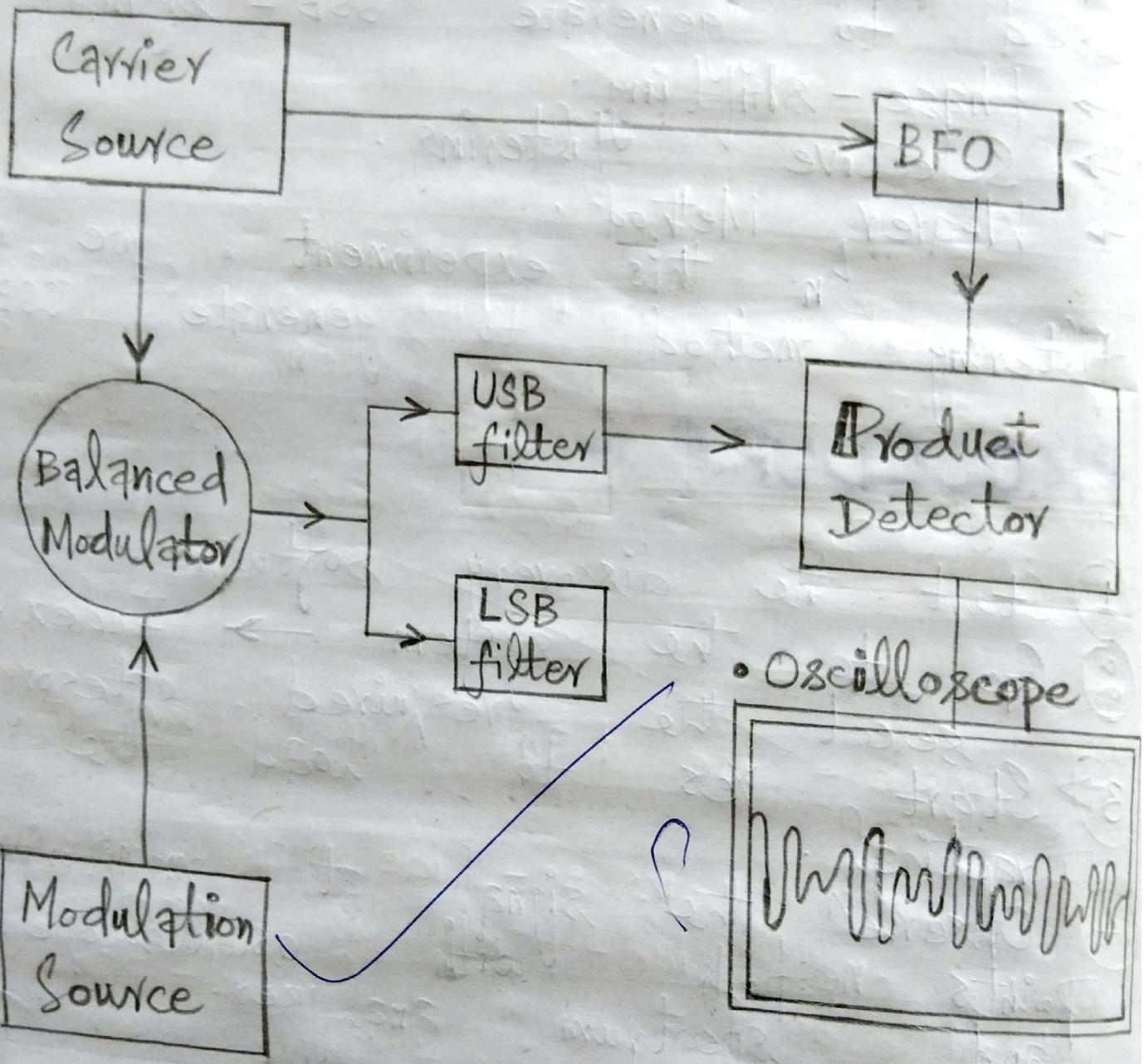
Demodulation of SSB - Signal



EXPERIMENT NO : 08

★ DEMODULATION OF SINGLE-SIDE BAND ★

APPARATUS :-

1. Amplitude Modulation Kit (S3 - 130).
2. Data Acquisition System RAT (S3 - 100).
3. PC with feedback discovery software oscilloscope.

THEORY :-

⇨ Demodulation of Single - side band :-

Recovery of original signal from the modulated single - side band is known as demodulation.

Demodulation of SSB - signal is done using synchronous detection, in which local carrier is used at receiver side, which has the same frequency and phase as carrier at transmitter side.

PROCEDURE :-

1. Start the discovery software.
2. Go to the System → Index → select the required category.
3. Start Yes to load the practical.
4. Observe the signals with oscilloscope.

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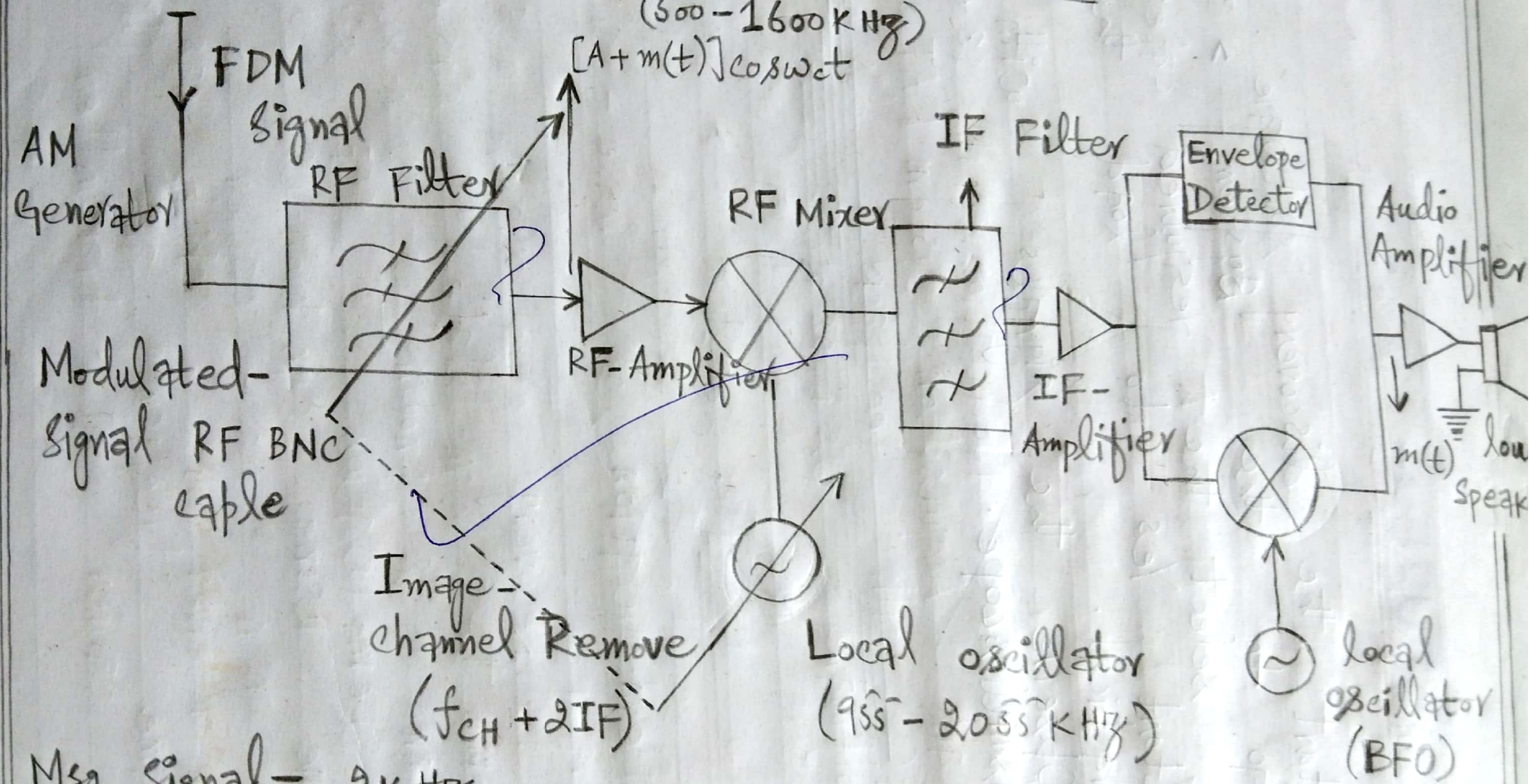
⇨ Super-heterodyne AM Receiver



Msg signal = 2K Hz

Carrier freq = 530 KHz

EXPERIMENT NO : 09

☆ SUPERHETERODYNE AM RECEIVER ☆

OBJECTIVE :-

⇨ To study superheterodyne AM receiver, its principle and frequency selection.

APPARATUS :-

1. Connecting wires.
2. Coaxial - cable with BNC connector.
3. AM Generator and superheterodyne AM receiver trainers.
4. Oscilloscope.

THEORY :-

⇨ Superheterodyne Receiver :-

A device that gives the original signal at output, by

receiving the signal through antenna from channel and doing the frequency conversion (by mixer), image rejection, filtering by IF amplifier, signal demodulation by envelope detector and audio amplification.

⇨ **Working :-**

Antenna of AM receiver intercepts the radio signals and feeds the RF amplifier, the RF selects the desired signal frequency by using capacitive tuning. After that signal is fed to mixer. The mixer take another input from local oscillator, which generates a frequency according to frequency of selected signal, so that difference equals a predetermined value. Difference component is called IF (intermediate frequency) which is 455 KHz.

For this purpose, "ganged capacitors" are used.

The IF signal is fed to an IF amplifier with two amplifier stages. Amplified IF signal is fed to the Envelope detector

or product detector for demodulation, and after amplified from the audio-amplifier it is finally given to loud-speaker, from where we get our original signal.

PROCEDURE :-

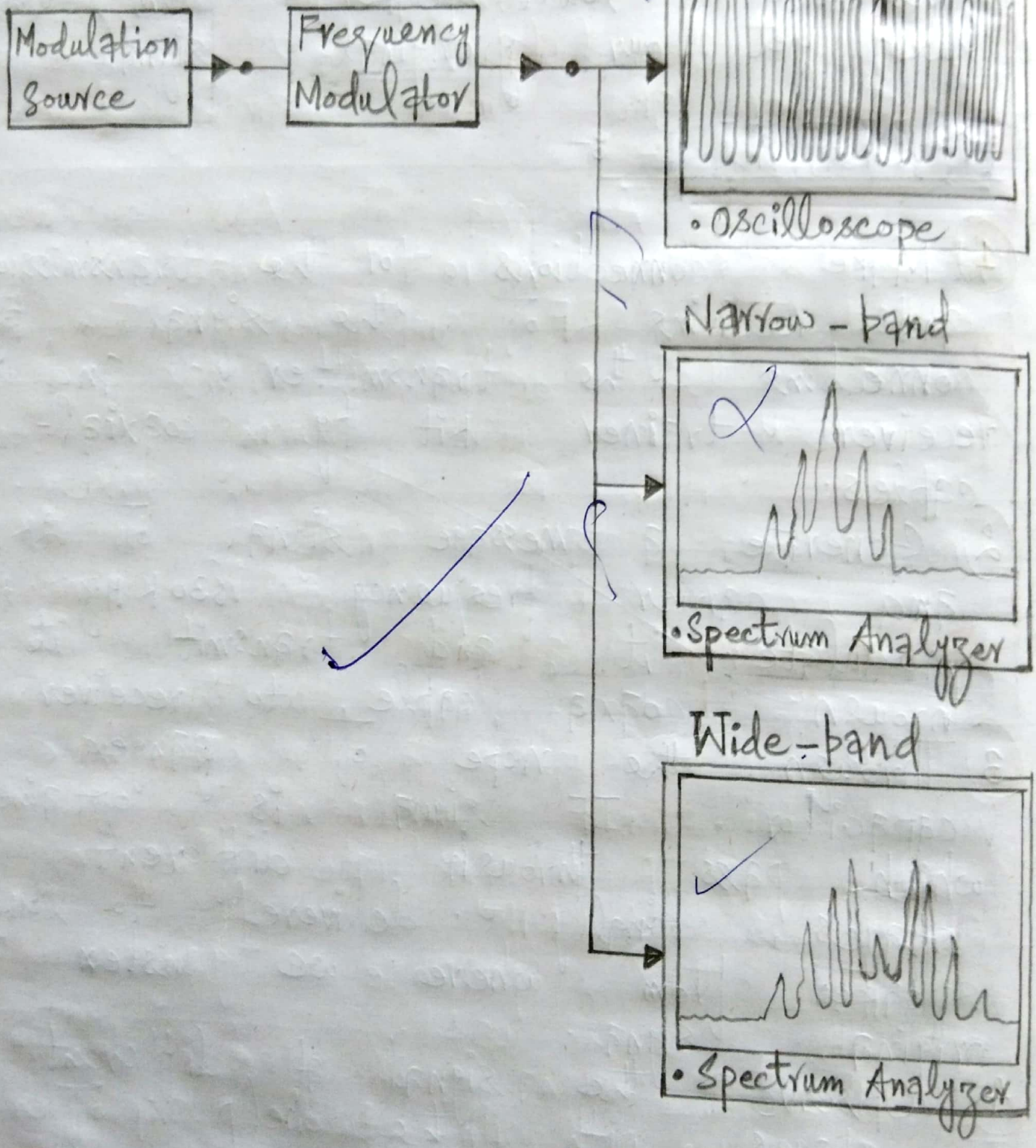
(1) Make connections for the transmission and receiving of the signal, by connecting the transmitter and receiver trainer kit by coaxial-cables.

(2) Generate a message signal of 2KHz and carrier frequency 30KHz, modulate it and transmit it through coaxial cable to receiver.

(3) Through the nope of ganged capacitor, IF signal is obtained, which pass through different stages, finally delivered to loud speaker from where we listen the original signal.

(4) Observe the signal at different stages with the help of oscilloscope.

FREQUENCY MODULATION



EXPERIMENT NO : 10

➔ CONCEPT OF FREQUENCY MODULATION

APPARATUS :-

1. PC with feedback discovery software
2. oscilloscope.
3. Spectrum Analyzer.

THEORY :-

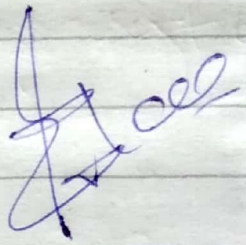
➔ Frequency Modulation :-

Frequency modulation means the carrier frequency of the signal is changed according to the message signal.

To carry out the Process of frequency modulation, there are few requirements, such as;

- ➔ Frequency Carrier Source.
- ➔ Modulation Source.
- ➔ Modulator.

If the strength of the message signal is decreased, so a narrow band is observed in the frequency domain. While, if the strength of the message signal is increased then the wide-band frequency modulated signal is observed.



PROCEDURE :-

1. Start the discovery software.
2. Go to the system → Index → Frequency modulation.
3. Start "Yes" to load assignment : 1.
4. Start the practical.
5. Observe the signals of the monitoring points, both with oscilloscope (t - domain) and with spectrum analyzer (f - domain).

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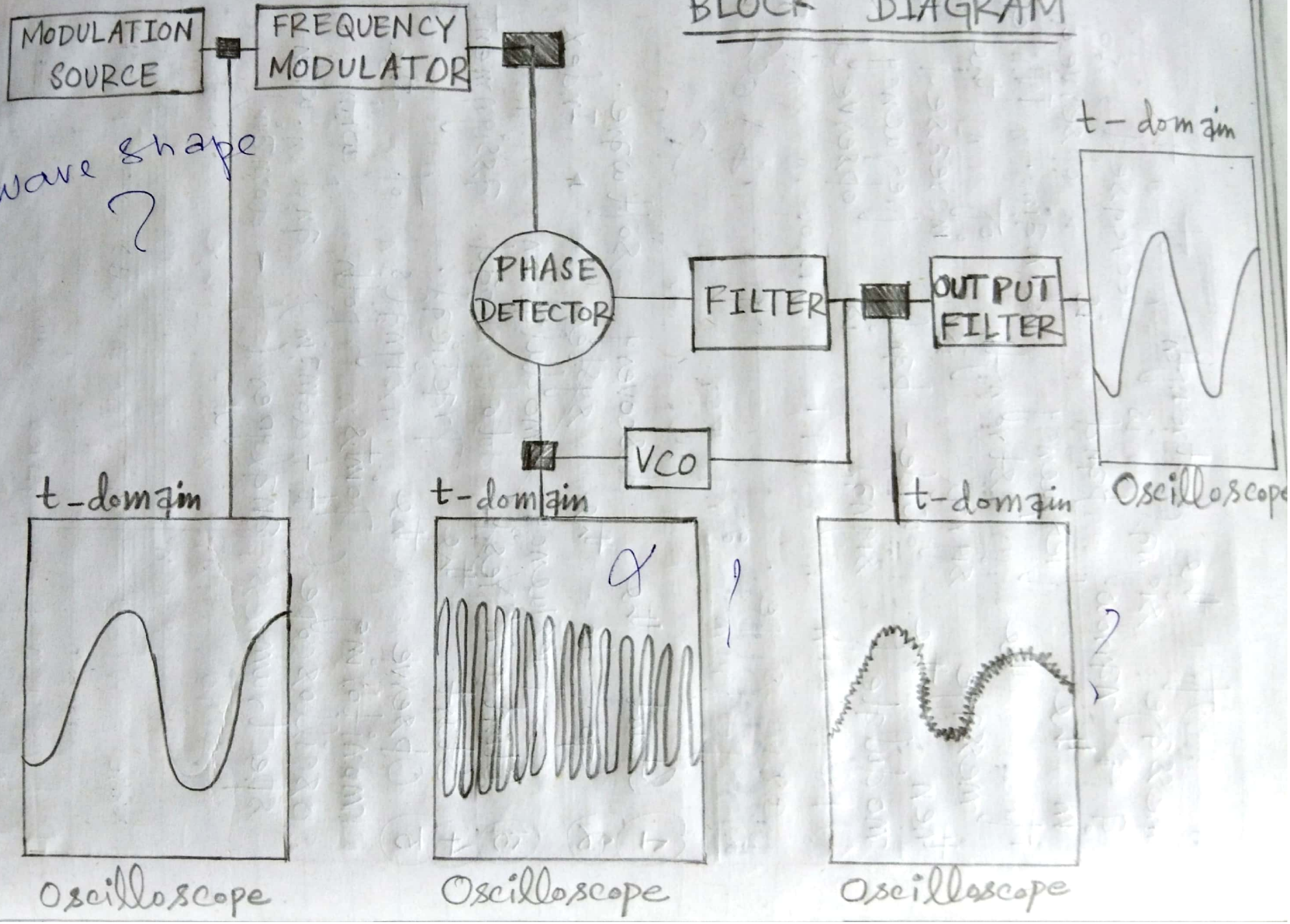
BLOCK DIAGRAM



EXPERIMENT NO : 11

⇨ Concept of frequency demodulation using Phase Locked Loop (PLL)

REQUIREMENTS :-

1. VCO.
2. Filter.
3. Output filter.
4. Modulation source.
5. Frequency Modulator.
6. Phase detector.

APPARATUS :-

i) PC with discovery software.
ii) Oscilloscope.

THEORY :-

✱) De-Modulation :-

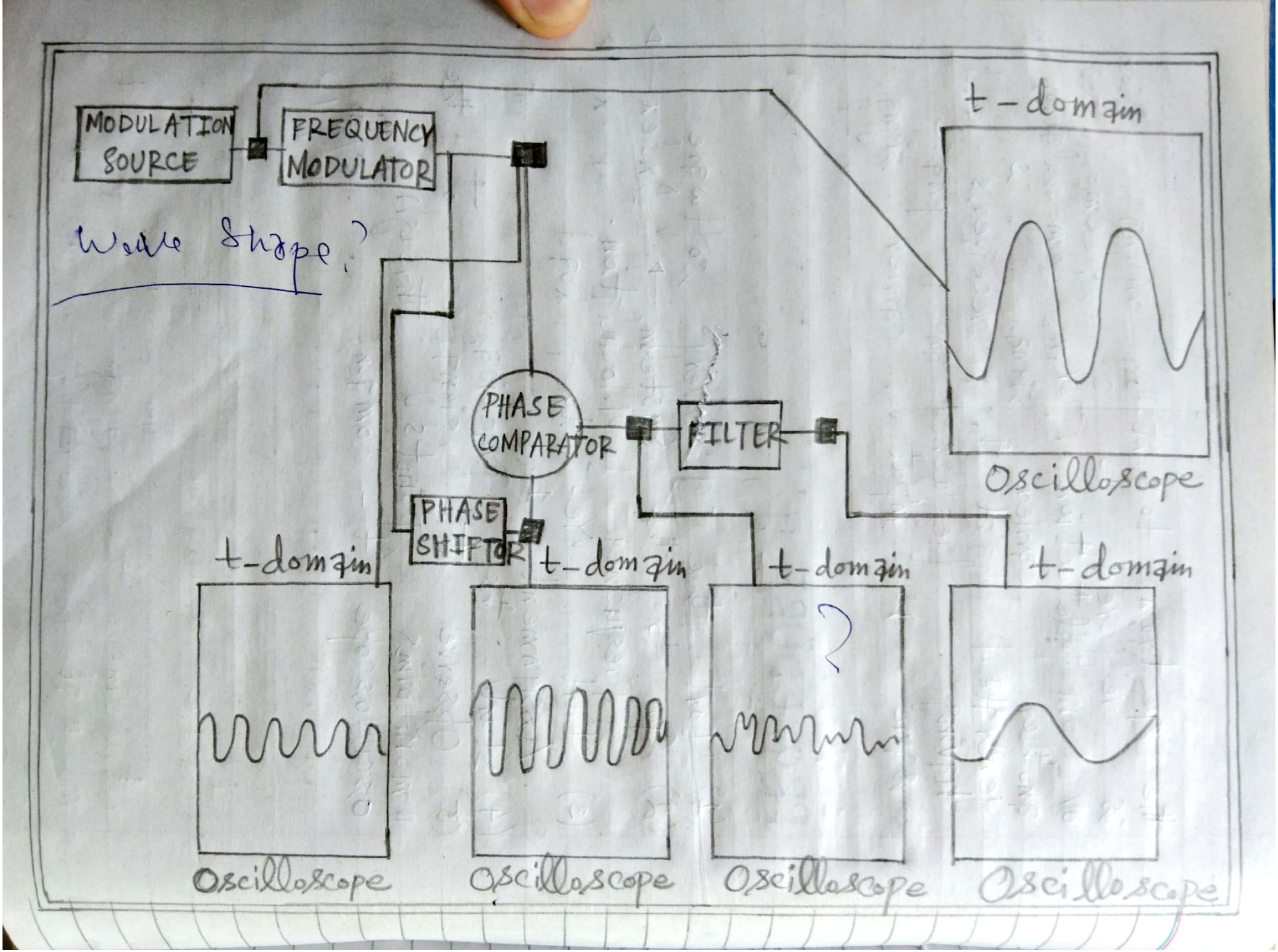
The process of translating the signal from the modulated signal retrieving the

the spectrum to its original position is referred to as demodulation or detection. For demodulation, another carrier signal is generated at the receiver's end having frequency and phase same as input carrier signal.

PROCEDURE :-

(1) Start the 'Discovery' software.
(2) Go to the System → Index → Frequency Modulation.
(3) Start 'Yes' to load Assignment : 1.
(4) Start the practical.
(5) Observe the signals of the monitoring points through oscilloscope (t - domain).

7/10



EXPERIMENT NO : 12

Concept of Frequency De-Modulation Using Quadrature Detector.

APPARATUS :-

1. PC with 'Discovery' software.
2. Oscilloscope.

REQUIREMENTS :-

1. Modulation Source.
2. Frequency Modulator.
3. Phase Shifter.
4. Phase comparator.
5. Filter.

THEORY :-

★ Quadrature Detector :-

Quadrature detector is a demodulation technique which builds on the utilization of a quadrature signal.

PROCEDURE :-

1. Start the 'Discovery' software.
2. Go to the System → Index → Frequency Modulation.
3. Start 'Yes' to load assignment : 2.
4. Start the practical.
5. Observe the signals of the monitoring points through oscilloscope (t - domain).

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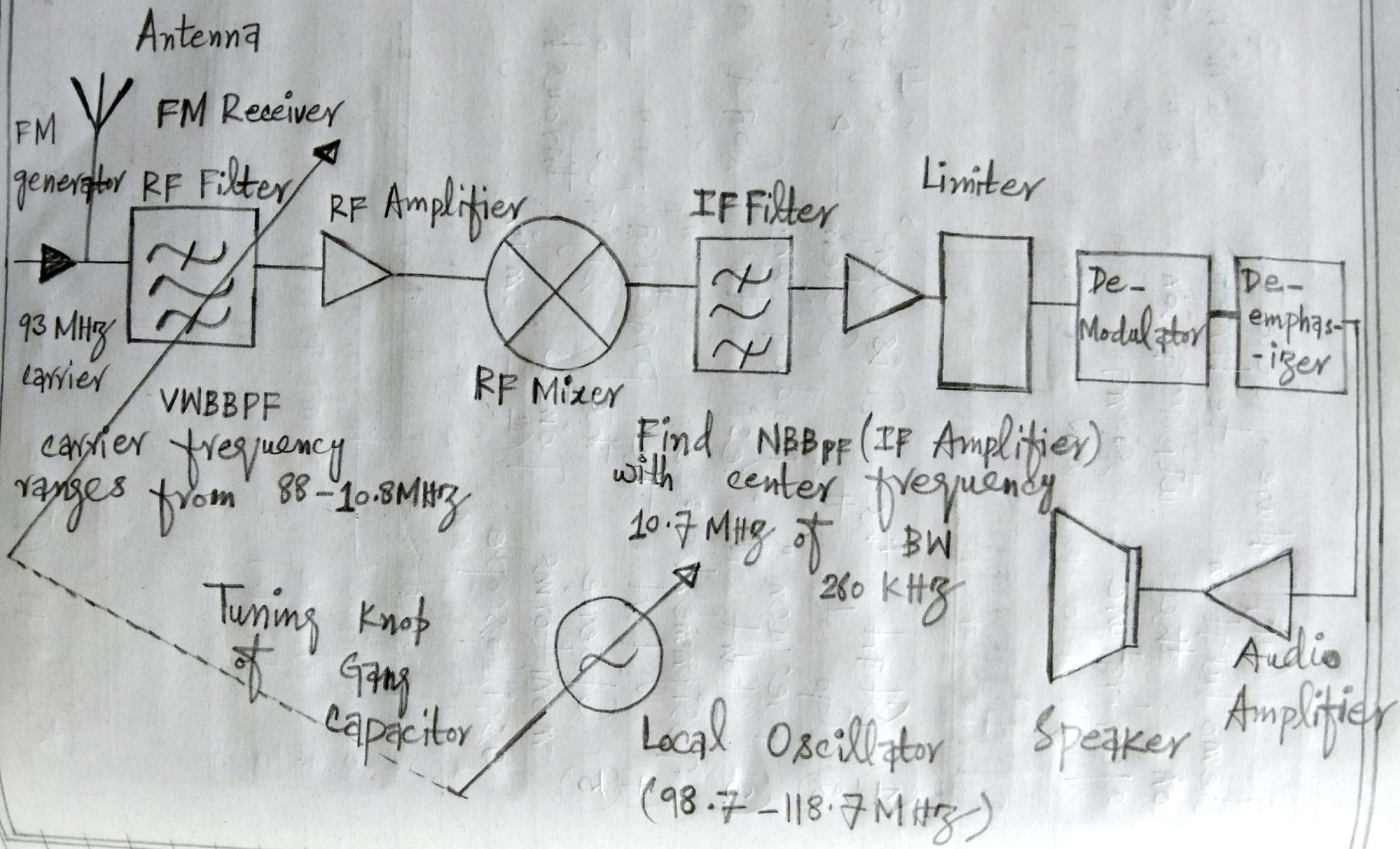
BLOCK DIAGRAM



EXPERIMENT No : 13

☞ Super Hetrodyne FM Receiver

APPARATUS :-

(1) FM Generator.
(2) RF Filter.
(3) RF Amplifier.
(4) RF Mixer.
(5) IF Filter.
(6) IF Amplifier.
(7) De- Modulator.
(8) Limiter.
(9) De - emphasizer.
(10) Audio Amplifier.
(11) Loud Speaker.

THEORY :-

(★) Super Heterodyne FM Receiver :-

A super hetero dyne FM receiver is a type of radio receiver that uses frequency

mixing to convert a received signal to a fixed intermediate frequency which can be more conveniently Processed than the original carrier frequency.

Incomplete.

PROCEDURE :-

(1) Generate a signal of 1.2 KHz at transmission side for better analysis, tone modulation is used.

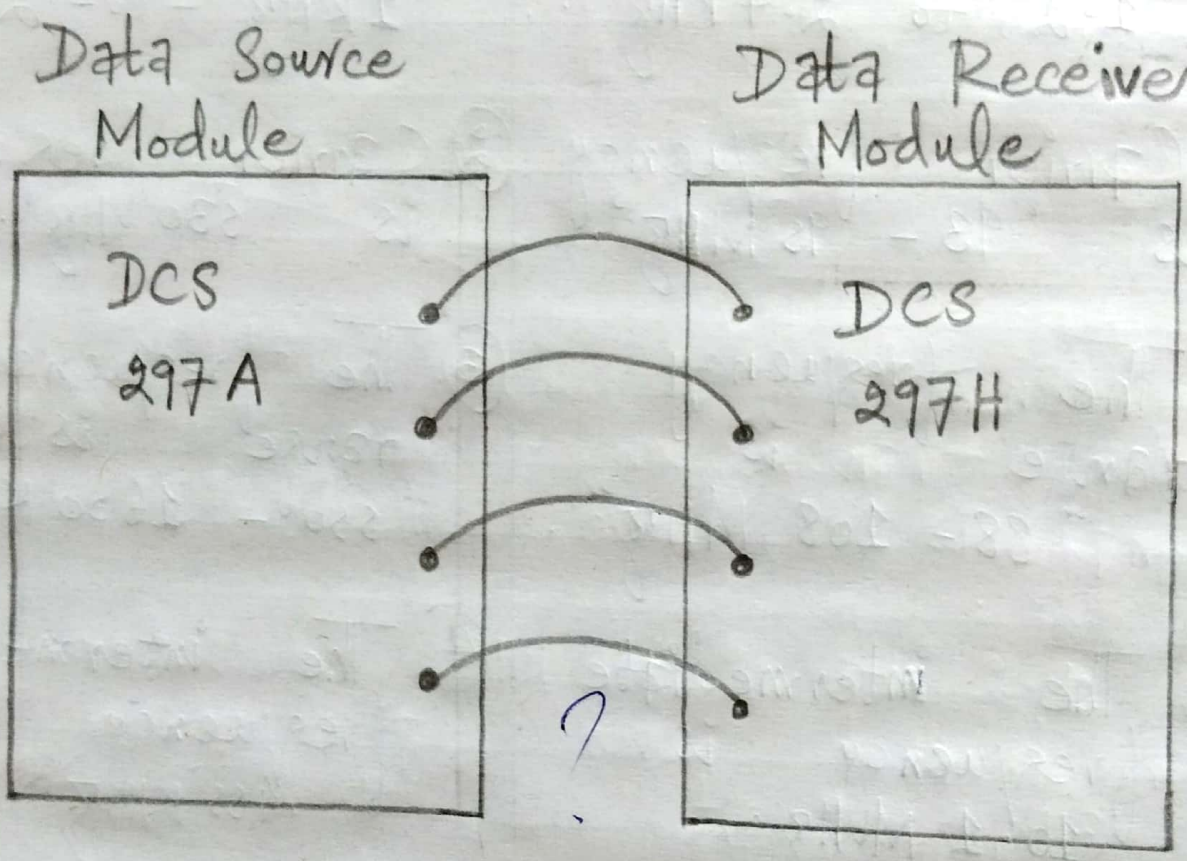
(2) 1.2 or 2.4 KHz message is modulated over a carrier of 93 MHz, it is then sent to FM receiver.

(3) At FM receiver, the modulated signal is demodulated and we hear a tone.

⇨ COMPARISION BETWEEN FM AND AM SUPER-HETERODYNE RECEIVER

FM Receiver	AM Receiver
(1) The message signal is about "1.2 to 2.4 KHz".	(1) The message signal is about "1KHz - to - 2KHz".
(2) Carrier frequency is "93 - 95 MHz".	(2) Carrier frequency is 530 Hz.
(3) The frequency range is "88 - 108 MHz".	(3) The frequency range is "530 - 1600 KHz".
(4) The intermediate frequency is 10.1 MHz.	(4) The intermediate frequency is 455 KHz.
(5) The frequency range of local oscillator is "88 - 108 MHz"	(5) The frequency range of local oscillator is 955 - 2055 KHz.
(6) The channel separation or bandwidth of IF filter is 200 KHz.	(6) The channel separation or bandwidth of IF filter is "10KHz".

⇨ Sending and Receiving Binary Data



EXPERIMENT No : 14

⇨ Sending and Receiving Binary Data

APPARATUS :-

1. Data Sender Module Dcs 297A.
2. Data Receiver Module Dcs 297H.
3. Connecting wires.

THEORY :-

⇨ Binary Data :-

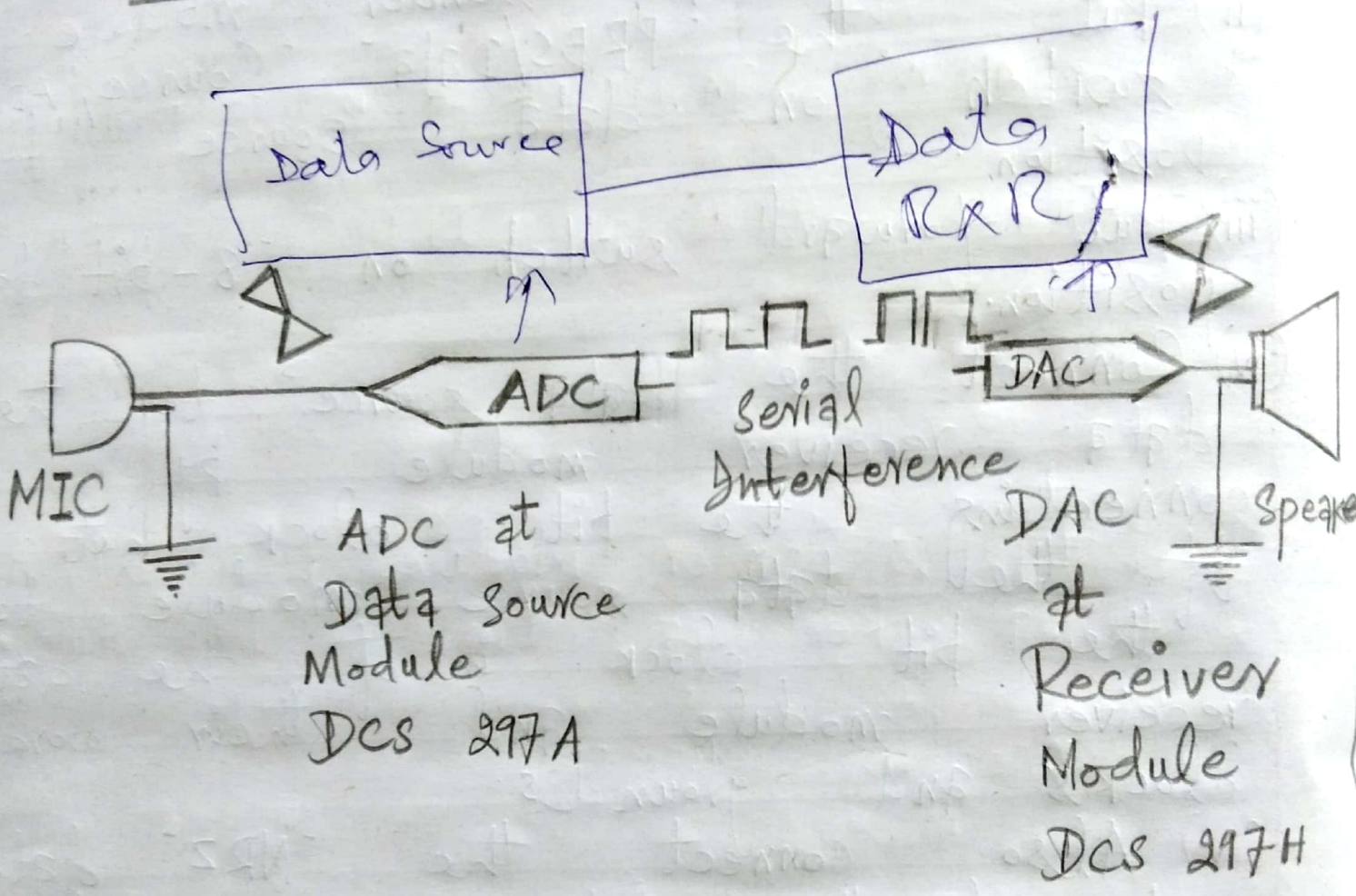
Binary data is also called as bits. Binary data is a data which can take only two states either '0' or '1'.

PROCEDURE :-

(i) Connect '160 KHz clock' to the

'clock w' of data sender module.
(ii) Put the 'PRBS/Data' 'Source/ADC1' switch on data source position.
(iii) Put forward switch on '8-bit data' position.
(iv) Connect the 'data source' to the data receiver module by connecting the bit clock out of the data source module to the bit clock in of the data receiver module and their word clocks and grounds.
(v) Also connect the 'NRZ data' out of the data source module to the 'NRZ data in' of the data receiver module.
(vi) Now press data switches on data source module according to bit streams to be sent. The LED's will light up according to their position. 8/10
(vii) We observe that the LED's of data receiving module also glow according to the position.
(viii) The bits are sent serially from source to receiver module.

To Establish an ADA Link :-



ADC at Data Source Module DCS 297A

DAC at Receiver Module DCS 297H

EXPERIMENT No : 15

⇨ To Establish an ADA Link

APPARATUS :-

1. Data Source Module Dcs 297 A.
2. Data Receiver Module Dcs 297 H.
3. Connecting wires.
4. Two mic speaker module Dcs 297K.
5. Power Supply Dcs 297 M.

THEORY :-

⇨ A to D Conversion :-

An analog to digital conversion system is a system that converts an analog signal to a digital signal.

PROCEDURE :-

1. Connect 'data source Module' to

the "data receiver module" source.

2) Get "mic" and "receiver module" from the connect output of the "data receiver module" to the input of the "speaker".

3) The analog input from the "MIC" is converted to the digital data by "ADC" at the data source module.

4) The digital data is sent serially to the data receiver module where it is converted back to the analog signal given out to the speaker.

5) This conversion from digital to analog data takes place at the data receiver module by "DAC".

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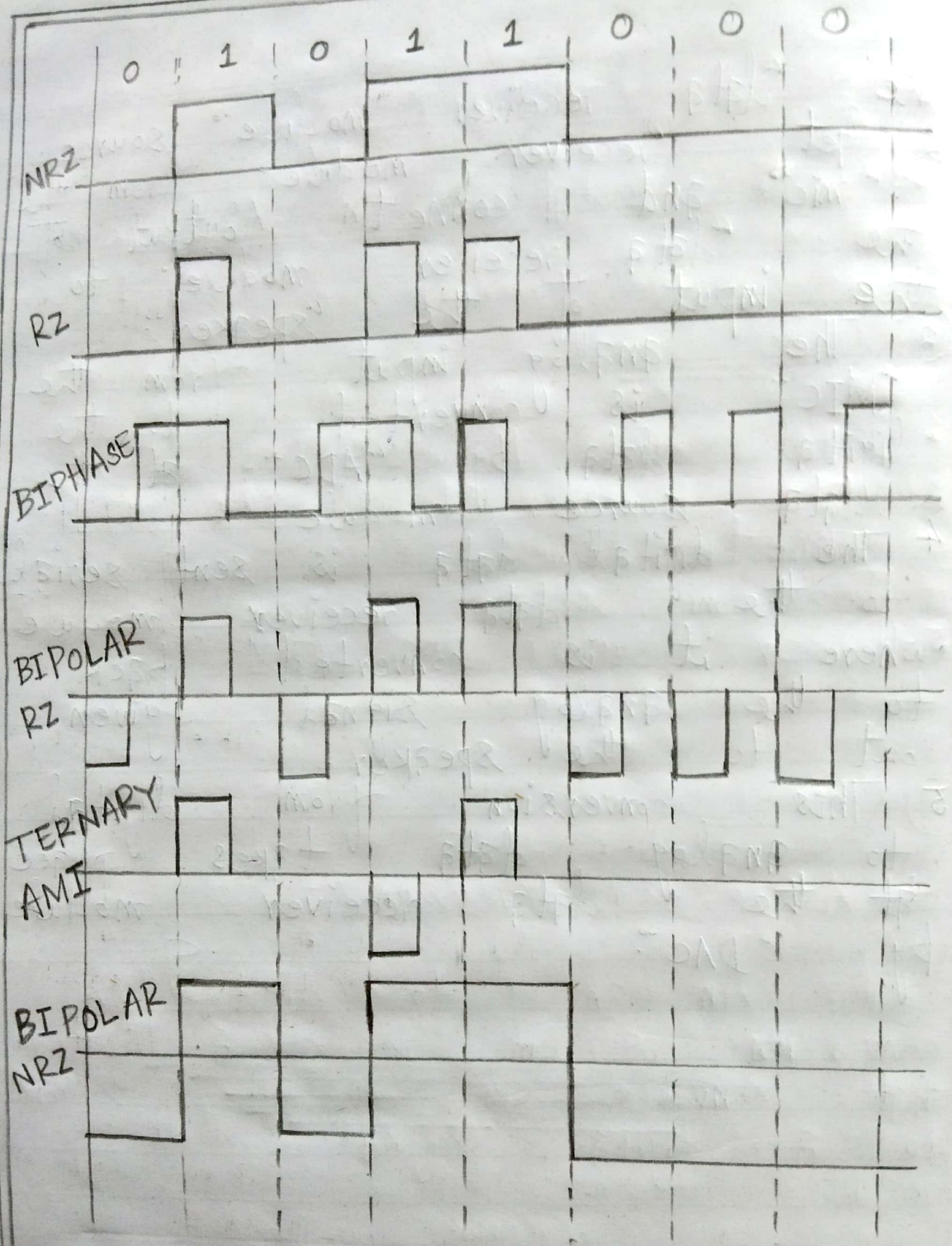

EXPERIMENT No : 16

⇨ To observe different data formats

APPARATUS :-

1. Data Source Module DCS 297 A
2. Data Format Module DCS 297 B
3. Power Supply DCS 297 M
4. Connecting wires.
5. Oscilloscope.

PROCEDURE :-

1. Connect 'Data Source Module' to the 'Data Format Module'.
2. Give some stream bit to the 'Data Source Module'.
3. This data is sent to the 'data Module'.
4. We have applied the data '01011000' from the Data Source Module.

(3) This oscilloscope is connected to the various format outputs and we observe this spectrum pattern.

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