Date 19/8/2020

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Experiment No : 01
SPECTRUM ANALYSER AND OBSERVE SPECTRUM
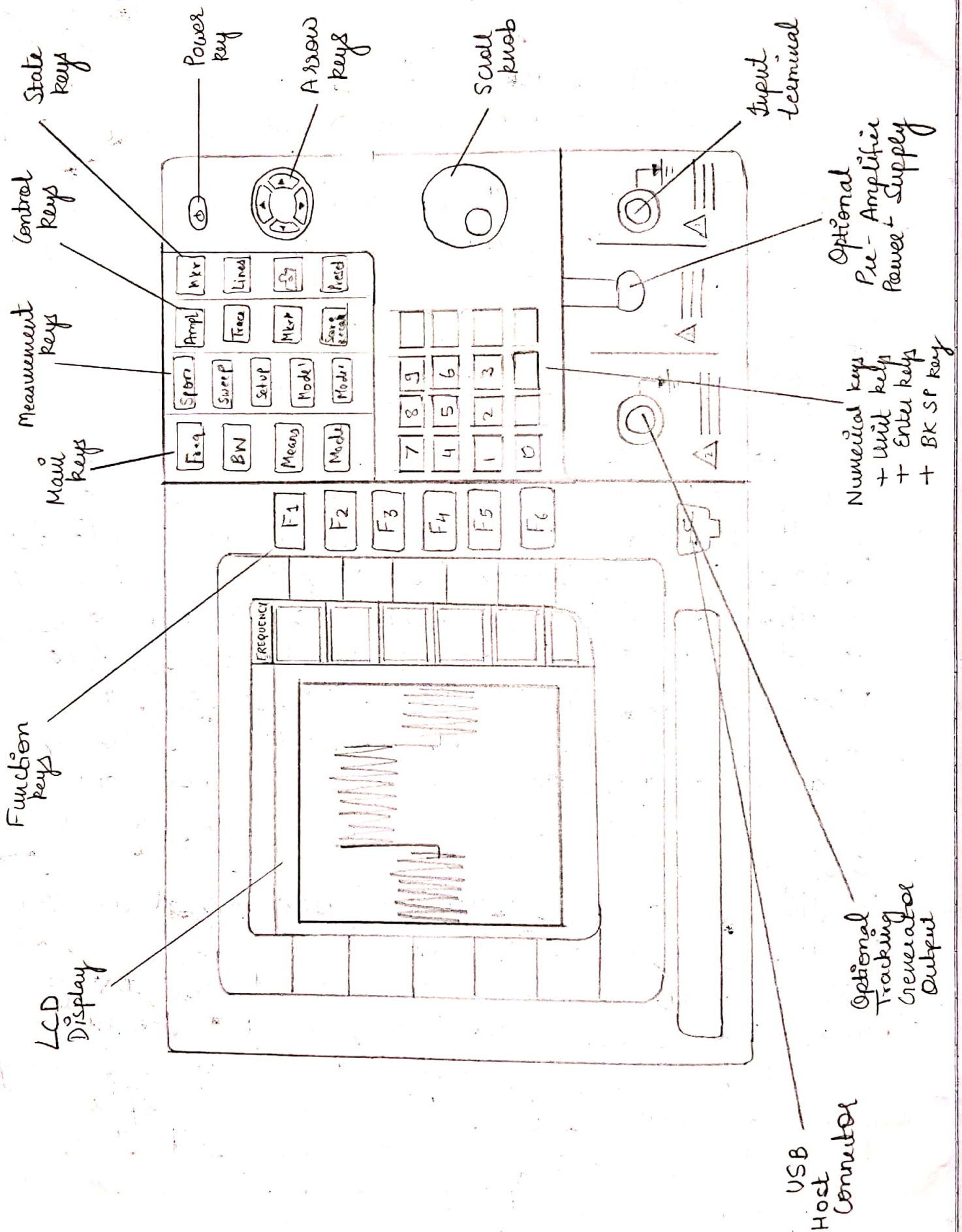
Aim: To study spectrum Analyser and observe the spectrum of sinusoidal signal and square wave.

Apparatus: Spectrum Analyzer (9kHz - 3GHz)
Function generator

Theory: A spectrum analyser is a laboratory instrument that displays signal amplitude (strength) as it varies by signal frequency. The frequency appears on the horizontal axis, and the amplitude is displayed on the vertical axis. To the casual observer, a spectrum analyzer looks like an oscilloscope and, in fact, some labs instruments can function either as oscilloscopes or spectrum analyzers.

A spectrum analyzer can be used to determine whether or not a wireless transmitter is working according to federally defined standards for purity of emissions. Output signals at frequencies other than the intended communications frequency appear as vertical lines (pips) on the display. A spectrum analyzer can also be used to determine, by direct observation, the bandwidth

State keys

Power key

Arrow keys

Scroll knob

Input terminal

Control keys

Measurement keys

Main keys

Optional Pre-Amplifier Power Supply

Function keys

Numerical keys + Unit keys + Enter keys + BK SP key

LCD Display

Optional Tracking Generator Output

USB Host Connector

FREQUENCY

F1 F2 F3 F4 F5 F6

Freq Span Ampl Mkr

BW Sweep Trace Lines

Means Setup Mkr

Mode Mode Mode Preset

7 8 9
4 5 6
1 2 3
0

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of digital or analog signal.

A spectrum analyzer interface is a device that can be connected to a wireless receiver or a personal computer to allow visual detection and analysis of electromagnetic signals over a defined band of frequencies.

FEATURES OF LAB INSTRUMENT GSP-830 (GWINSTEK)

- 5 markers with delta marker and peak functions
- 3 traces
- Split windows with separate settings
- 6.4" TFT color LCD, 640×480 resolution
- AC/DC/battery multi-mode power operation
- Autoset
- 9 khz – 3 GHz frequency range

1) FREQUENCY

- Frequency/Span: The frequency key, together with span key sets the frequency scale
- View Signal (center & span): center and span method defines the center frequency and the left/ right bandwidth (span) to locate the signal
- Setting frequency adjustment step: Frequency adjustment step defines the arrow keys resolution for center, start and stop frequency

Panel Operation:

→ Press frequency key
→ Press F4 (step)
→ Enter the value using numerical and unit keys, arrow keys and scroll nope.

2) RANGE: 9kHz to 8GHz

3) SET CENTER FREQUENCY
   Panel Operations:
   • Press frequency key
   • Press F1 (center)
   • Enter the value using numerical & unit keys, arrow keys and scroll nope

4) SET FREQUENCY SPAN
   Panel Operations:
   • Press span key
   • Press F1 (span)
   • Enter the value using numerical and unit keys, arrow keys and scroll nope.

5) VIEW SIGNAL (START & STOP)
   • Start and stop method defines the beginning and the end of frequency range
   • Arrow keys and scroll knobe resolution: 1/10 of span

6) SET START FREQUENCY
   Panel Operation:

- Press frequency key
- Press F2 (start)
- Enter the value using numerical and unit keys, arrow keys and scroll nope

7) SET STOP FREQUENCY
Panel Operation:
- Press frequency key
- Press F3 (stop)
- Enter the value using numerical keys, arrow keys and scroll nope

8) FULL OR ZERO SPAN
- Full or zero span setting sets the span to extreme values: 3 GHz (full) or 0 KHz (zero) they provide faster ways to view signals in certain situations such as in time domain (0 span) for viewing modulation or in full span for viewing signals with unknown frequencies.

9) DISPLAY FULL FREQUENCY SPAN
Panel Operation:
- Press the span key
- Press F2 (full span)
- Range: 3 GHz (fixed)
- Full span also sets these parameters to fixed values
- Center frequency: 1.5 GHz
- Start frequency: 0 KHz
- Stop frequency: 3 GHz

10) ZERO SPAN DISPLAY
- Zero span display can be obtained by pressing F3 key
- Start frequency and stop frequency remains same as that of center frequency
- Note: Last span setting can be recalled by F4 key.

AMPLITUDE SELECTION AND SETTINGS METHODS

1) AMPLITUDE
- Amplitude key sets vertical attribute of the display, including the upper limit (reference level), vertical range (amplitude scale), vertical unit and compensation for external gain or loss (external offset)

2) SET VERTICAL SCALE
- Vertical display scale is defined by reference amplitude, amplitude range, measurement unit and external gain / loss.

3) SET REFERENCE AMPLITUDE
- The reference level defines the amplitude at the top of the displayed range.
- Panel Operation:
- Press amplitude key
- Press F1 (reference level)
- Enter the value using numerical & unit keys, arrow key and scroll knob. Arrow keys & scroll knob, scroll knob resolution: vertical scale.

Range:

→ dBm -110 to +20 dBm, 0.1 dB resolution

→ dBmV -63.1 to 66.99 dBmV, 0.01 dB resolution

→ dBμV -3.01 to 126.99 dBμV, 0.01dB resolution

4) SELECT AMPLITUDE SCALE

Panel Operation:

- Press amplitude key
- Press F2 (Scale dB/Div)
- Repeatedly to select the scale
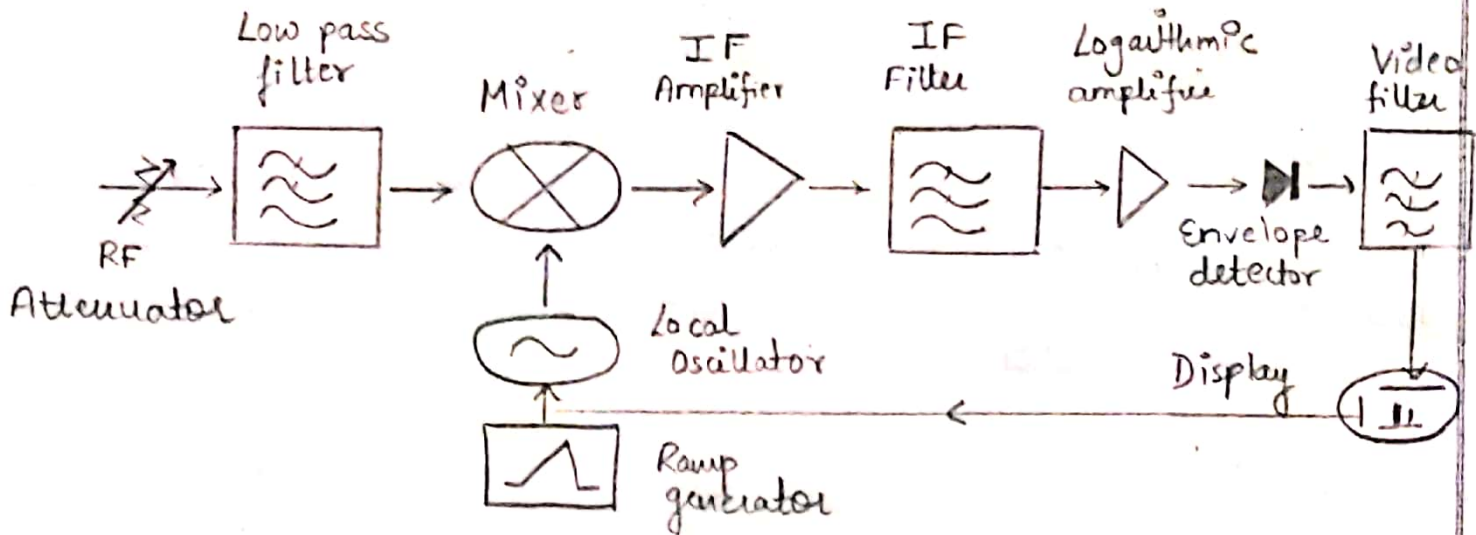
Range: 10, 5, 2, 1 dB/Div

Panel Operation:

- Press amplitude key
- Press F3 (Units)
- Select and press the unit from F1 (dBm), F2 (dBmV) and F3 (dBμV)
- Press F6 (return) to go back to previous menu
- dBm -110 to +20 dBm, 0.1 dB resolution
- dBmV -63.1 to 66.99 dBmV, 0.01 dB resolution
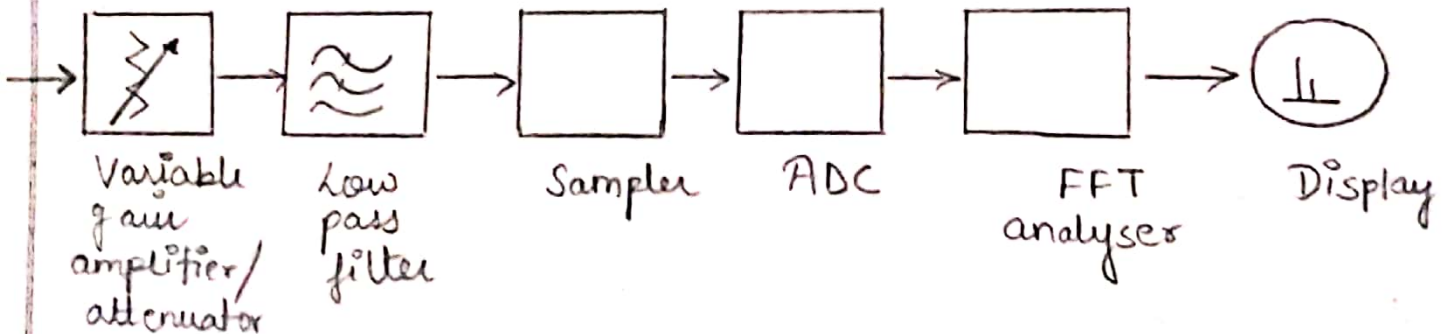- dBμV -3.01 to 126.99 dBμV, 0.01 dB resolution
- Set external offset level.

5) BACKGROUND:

- External offset compensates the amplitude gain or loss caused by an external network or device.

Panel Operation:

- Press amplitude key

BLOCK DIAGRAM:

Low pass filter

Mixer

IF Amplifier

IF Filter

Logarithmic amplifier

Video filter

RF Attenuator

Local Oscillator

Envelope detector

Display

Ramp generator

(Superheterodyne or swept frequency spectrum analyzer) block diagram

Variable gain amplifier/ attenuator

Low pass filter

Sampler

ADC

FFT analyser

Display

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- Press F4 (external gain)
- Enter the value using numerical and unit keys, arrow keys and scroll knob

Range:

-20 dB to +20 dB, 0.1 dB resolution

Icon:

- The amplitude icon appears at the bottom of the display when the external offset changes
- To check whether Spectrum analyzer working properly.
- Generate Auxilary signal: Press system key, press auxiliary signal, select on option from side given menu, following signal will generate. It generates 10 MHz signal with 10 dB amplitude

Observation:

WAVEFORM : SINE			
S.No.	Frequency (kHz)	Amplitude (mv)	
1)	2	1	
2)	2.5	1.1	
3)	3	1.5	
4)	3	2	
5)	5	2.4	

WAVEFORM : SQUARE

4)

5)
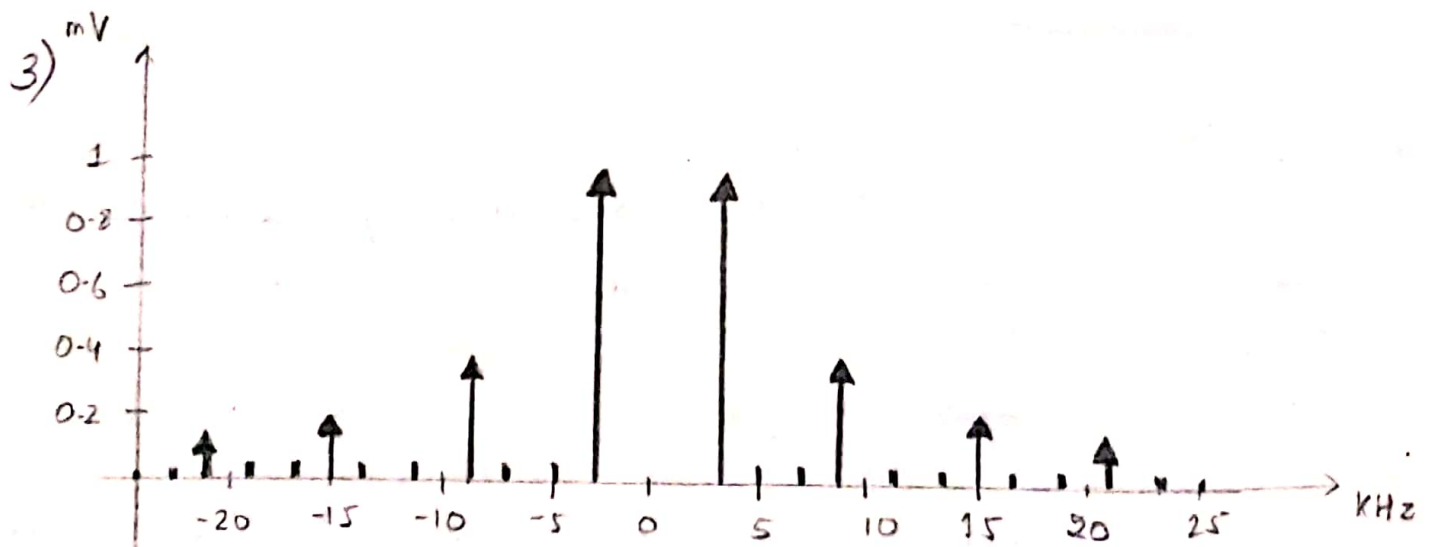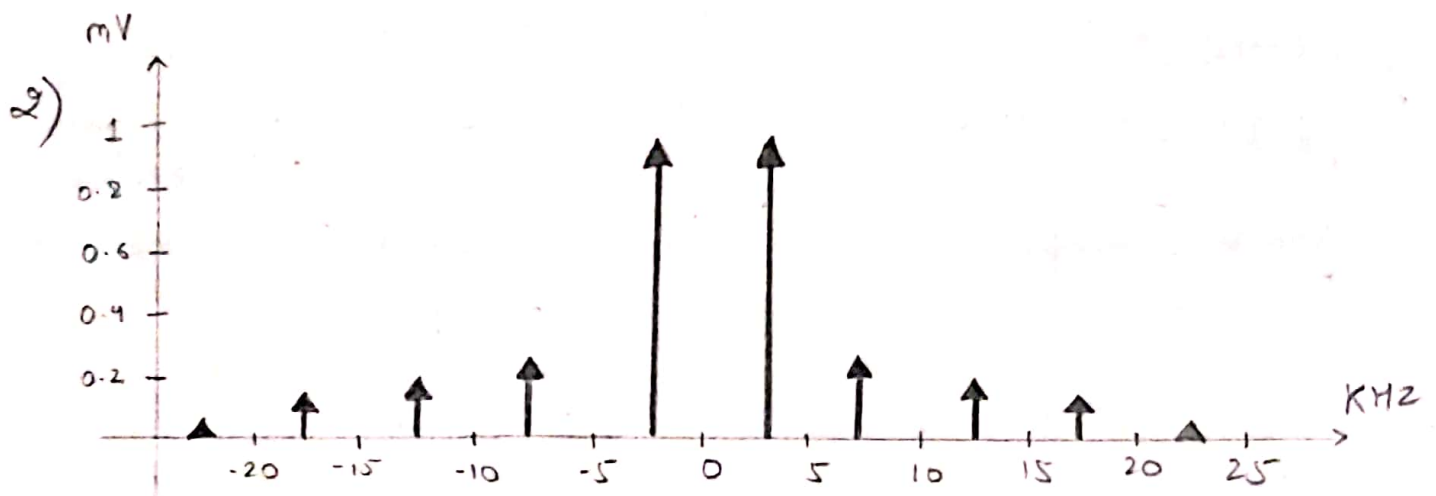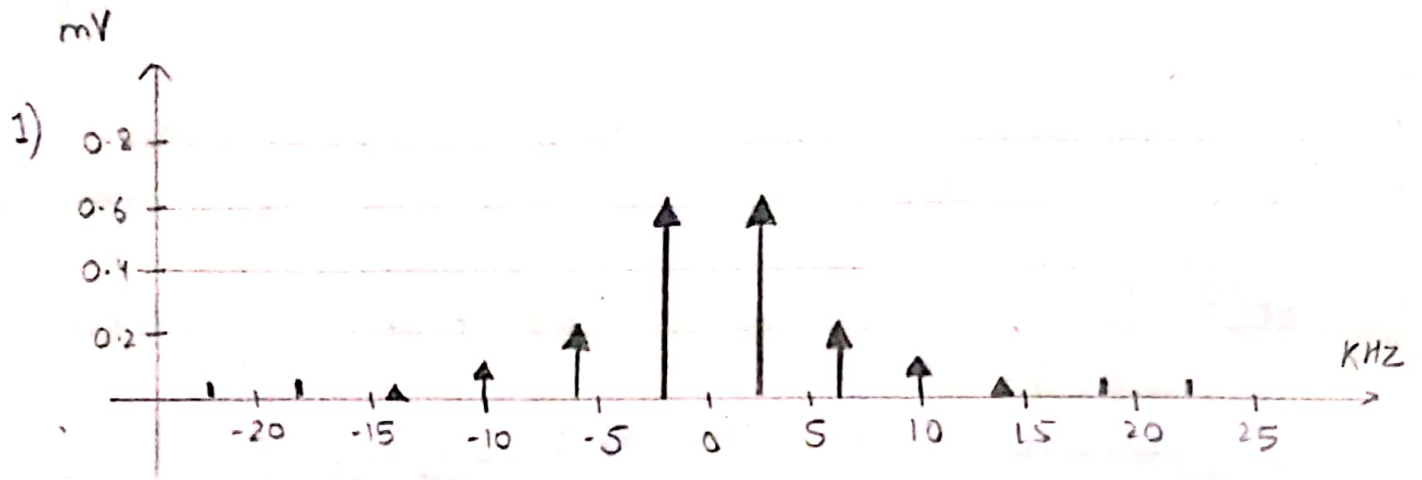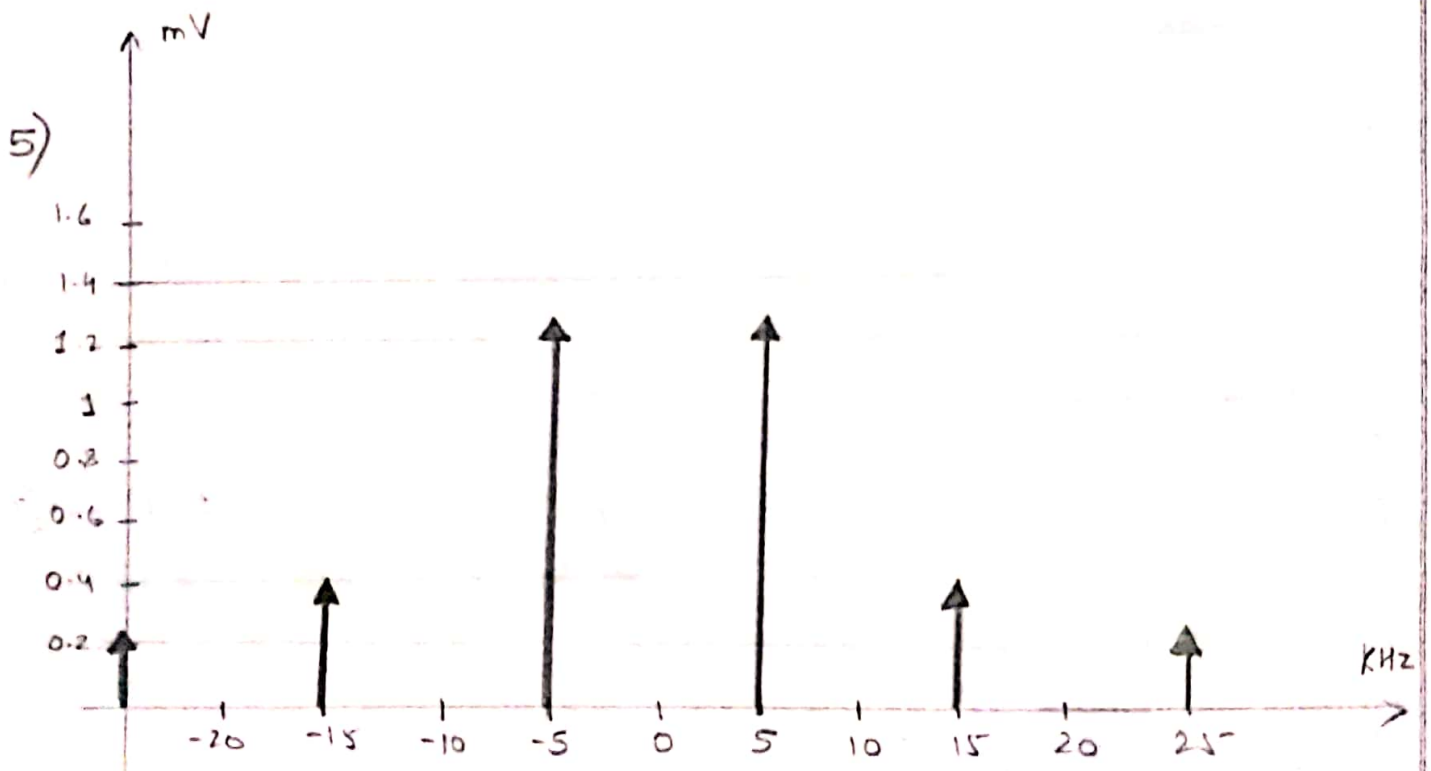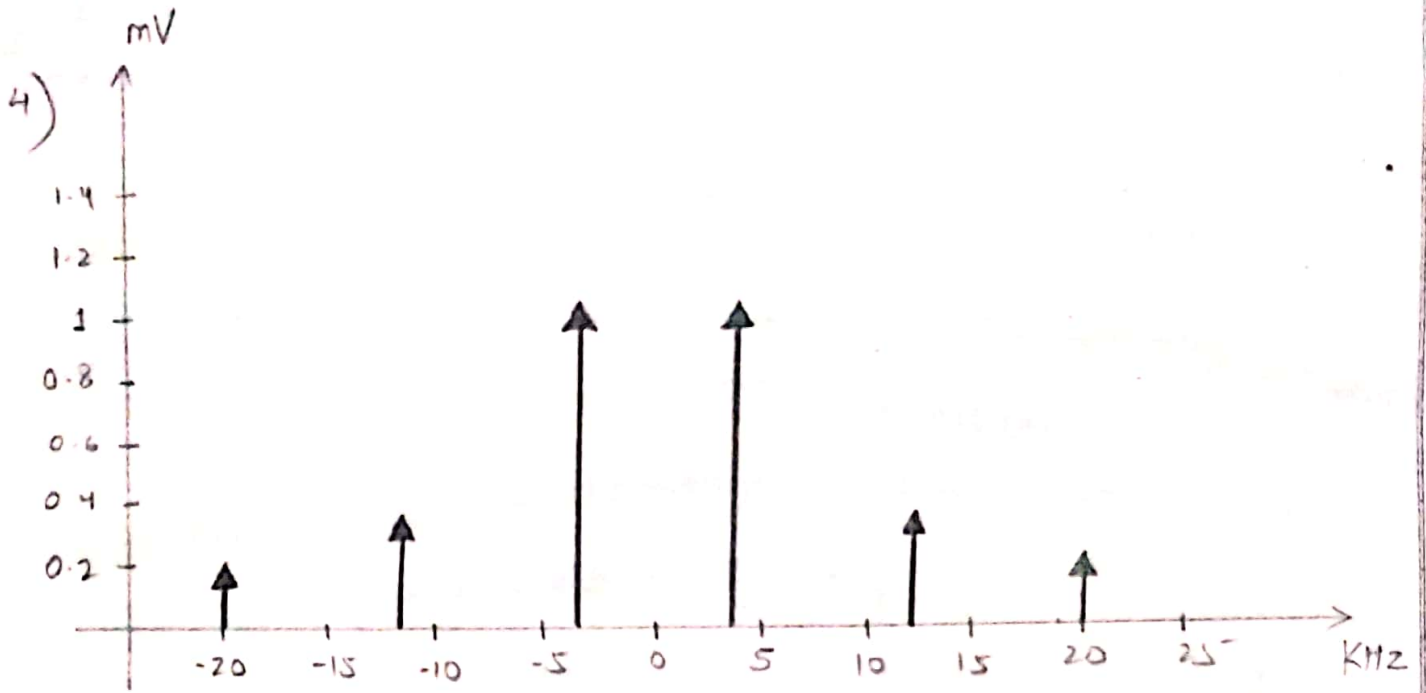
WAVEFORM : SQUARE		
S.NO	Frequency (KHZ)	Amplitude (mV)
1)	2	1
2)	2.5	1.2
3)	3	1.5
4)	4	1.6
5)	5	2

Conclusion :

Hence, successfully verified and analyzed the spectrum of Sine and square wave-form for different frequency and amplitude.

WAVEFORM : SQUARE

1)

2)

3)

4)

5)