Table of content

Week	CO	PO	Lecture (Knowledge Criteria)	Practice (PerformanceCriteria)
			3 hours/week	4 hours/week (2 hours/batch twicein a week)
1	1	1,4,5	**Network theorems** 1. Superposition theorem- statement and explanation with an example. 2. Maximum Power Transfer theorem-statement and explanation with an example. 3. Thevenin's theorem & Norton's theorem- statements and explanwith an example each.	1. Construct andverify maximumpower transfer theorem. 2. Construct and verify Thevenin'stheorem.
2	1,3	1,2,4,6	Resonance 1. Series resonance - circuit diagram, phasor diagram, resonance plot and characteristics. 2. Condition for series resonance, expression for frequency of resonance. Parallel resonance- circuit diagram, phasor diagram. 3. Parallel resonance-resonance plot and characteristics, Condition for resonance, expression for frequency of resonance.	1. Construct a series/parallel resonant circuit and plot its frequency response. 2. Construct a series/parallel resonant circuit and find its bandwidth and Q factor.
3	1,3	1,2,4,6	Filters 1. Classification of filters, cut-off frequency, pass band and stop band. 2. Ideal characteristics curve of passive LPF, HPF, BPF and BRF. 3. Circuit diagram & formula for cut-off frequency of T and Π configurations of LPF and HPF.	1. Construct and test the passive low-pass T-type filter circuit for a given cut-off frequency. 2. Construct and test the passive high pass Π -type filter circuit for a given cut-off frequency.
4	1,3	1,2,4,6	Attenuators 1. Classification and applications of attenuators. Definition of Bel, Decibel and Neper. 2. Symmetrical T type attenuator- Circuit diagram, expression for attenuation. 3.Symmetrical Π type attenuator- Circuit diagram, expression for attenuation	1. Construct and test T type attenuator circuit for the given attenuation & Ro. 2.Construct and test Π type attenuator circuit for the given attenuation & Ro.
5	1,2,3	2,3,4,5	Transmission Media 1. Need, different types of transmission media(guided, unguided), Transmission lines- Electrical model, Primary constants - R, L, G and C , Secondary constants - Characteristic Impedance and Propagation Constant. 2. Optical fiber -principle of operation, Numerical aperture, Angle of acceptance, Classification, fiber losses. 3...Basic components of Fiber optic system, splices, connecters, couplers and switches.	1. Demonstrate PC to PC communication using Fiber Optic Digital Link. 2. Demonstrate installation , testing, repair and power budgeting of fiber optic cable (using simulator/video)

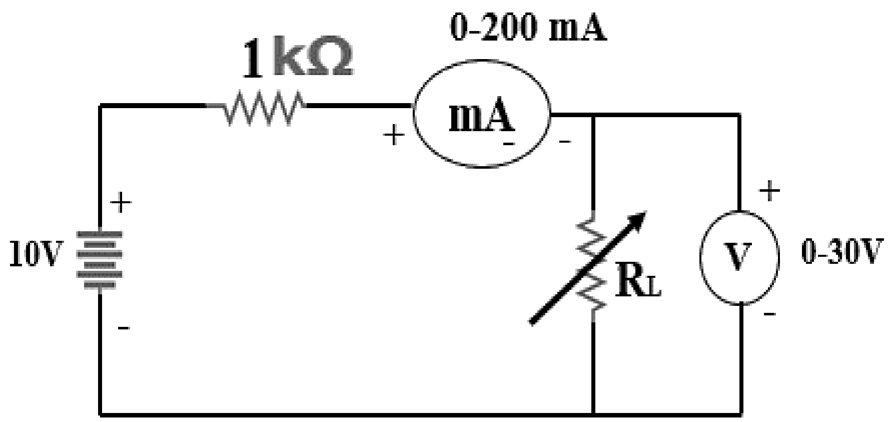
6	1,2,3	1,4,5,6	Antennas 1. Concept of electric and magnetic fields in a dipole, antenna terminology- polarization, radiation pattern, antenna gain, directive gain, directivity, power gain, antenna resistance.	1. Video demonstration and documentation on the working of the dipole antenna and observe its radiation pattern.
			2. Antenna efficiency, beam width, bandwidth, isotropic radiators. Effects of ground on antennas, effect of antenna height, Antenna types, examples and applications. 3. Working of Dish Antenna, Feed mechanisms- Cassegrain and Horn feed.	2. Video demonstration and documentation of antenna types with examples and applications.
7	2,3	1,4,5,6	Wave Propagation 1. Wave Propagation: Fundamentals of Electromagnetic Waves, electromagnetic spectrum. 2. Modes of wave propagation-ground wave propagation and sky wave propagation and space wave propagation, comparison. Analog modulation 3. Block diagram of communication system, Need for modulation and types of analog modulation techniques.	1. Video demonstration and documentation on the fundamentals of electromagnetic waves and electromagnetic spectrum. 2. Video demonstration and documentation on the need for modulation and demodulation techniques.
8	3	1,2,3,4,6	1. AM Transmitter and Receiver -block diagram & waveforms. 2. Expressions for modulating signal, Carrier signal, modulated signal, modulation index and power. 3. Frequency Transmitter and Receiver- block diagram, waveform, Expressions for frequency deviation, modulation index.	1. Construct and verify amplitude modulation and demodulation using kit. 2. Construct and verify frequency modulation and demodulation using kit.
9	1,3	1,3,4,5,6,7	Digital communication 1. Block diagram of digital communication system. Definition of information capacity, entropy, bit-rate, baud rate and bandwidth of digital data. 2. Sampling- Sampling theorem for low pass and band pass signals, Nyquist criterion and aliasing effect. 3. Explain Analog pulse modulation techniques-PAM, PPM, PWM using waveforms.	1. Verify sampling theorem for low pass signals using kit. 2. Conduct an experiment to study the effect of aliasing using kit.
10	1,3	1,2,3,4,6	Digital Coding 1. Quantization -process, classification. Quantization noise and companding process. 2. PCM and DPCM system. 3. Delta modulation and adaptive delta modulation system.	1. Perform an experiment to study Pulse Code Modulation and Demodulation using kit. 2. Generation of Delta modulated signal using kit.

11	1,3	1,2,4,6	1. Baseband transmission - significance of inter symbol interference (ISI) and eye pattern. Digital modulation techniques-types. 2. Generation and detection of Binary ASK and Binary FSK. 3. Generation and detection of Binary PSK and QPSK.	1. Perform an experiment to generate and detect BASK signal using kit. 2. Perform an experiment to generate and detect BPSK signal using kit.
12	1,3	1,2,6,7	Multiplexing 1. FDM & TDM- concept applications 2. PAM/TDM system -Block diagram, transmission bandwidth, synchronization, crosstalk and guard time. 3. Digital multiplexers-Principle, classification and performance factors.	1. Demonstrate TDM using Fiber Communication System. 2. Video demonstration and documentation of FDM and TDM.
13	3	1,2,4,6	Error detection & correction 1. Errors-types, redundancy, error control schemes. 2. Error control codes- types, Parity check bit coding, error detection methods-LRC. 3. VRC, CRC, Checksum with examples.	1. Video demonstration and documentation of error detection and correction. 2. Video demonstration and documentation on LRC, VRC, CRC.
Total in hours			**39**	**52**

Expt No.1 **Date: ____________**

Expt Name: Construct and Verify Maximum Power Transfer Theorem

Circuit diagram:



Tabular column:

Sl. No.	R_L(in Ω)	I_L (in mA)	V_L (in Volts)	Output Power Pout = V_L* I_L (in mW)
1				
2				
3				
4				
5				
6				
7				
8				
9				

Expt No.1: Construct & Verify Maximum Power Transfer Theorem

Aim: To verify Maximum Power Transfer Theorem.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	DigitalMultimeter	-------	2
2	Resistors	1KΩ	1
3	RegulatedPowerSupple	0-30V	1
4	POT or Decade Resistance Box	-------	1

Theory:

The **Maximum Power Transfer Theorem** states that in a linear, bilateral DC network, Maximum Power is delivered to the load when the load resistance is equal to the internal resistance of the source.

Precautions:

1. Voltage control knob of RPS should be kept at minimum position.
2. Current control knob of RPS should be kept at maximum position

Procedure:

1. Connect the circuit as shown in circuit diagram
2. Keep input voltage to 10V.
3. Vary the load resistors, record the load voltage (V_L) and load current (I_L).
4. Calculate the power **Pout = V_L* I_L**for each reading.
5. It is observed that when R_L = 1KΩ , maximum power is transferred to the load.

Result:

Maximum Power transfer theorem is verified.

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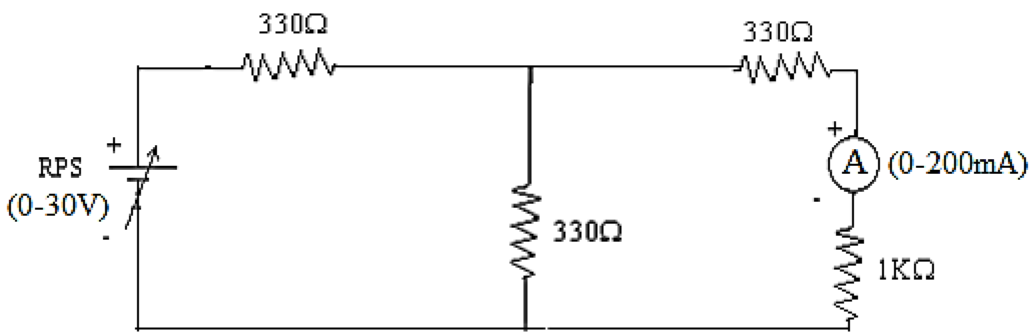
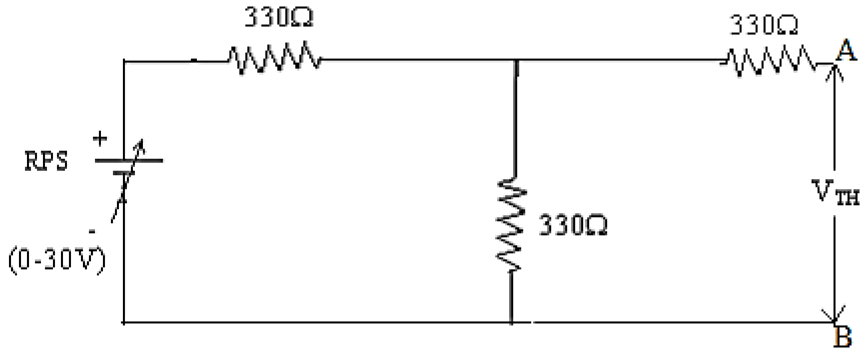
Expt. No.2 **Date: ____________**

Expt. Name: Construct and Verify Thevenin's Theorem

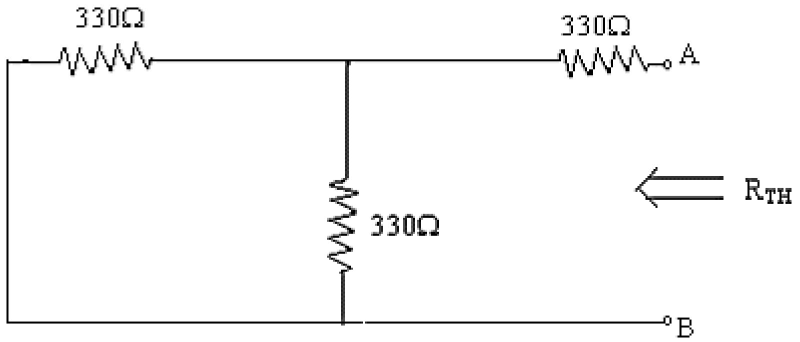
Circuit 1:



Circuit to find V_{TH}:



Circuit to find R_{TH}:



Expt. No. 2: Construct and Verify Thevenin’s Theorem

Aim: To verify Thevenin’s Theorem.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	RPS (Regulated Power Supply)	0-30V	1
2	Digital Multimeter	------	1
3	Resistor	1KΩ, 330Ω	1,3
4	DRB (Decade Resistance Box)	-------	1
5	Bread Board	-------	1

Theory:

Any linear bilateral, active two terminal network can be replaced by a equivalent voltage source (V_{TH}) Thevenin’s voltage in series with a resistance R_{TH} (Thevenin’s resistance).

Precautions:

1. Voltage control knob of RPS should be kept at minimum position.
2. Current control knob of RPS should be kept at maximum position

Procedure:

1. Connections are given as per the circuit diagram.
2. Set a 10V using RPS and note down the corresponding ammeter readings (I_L in circuit).

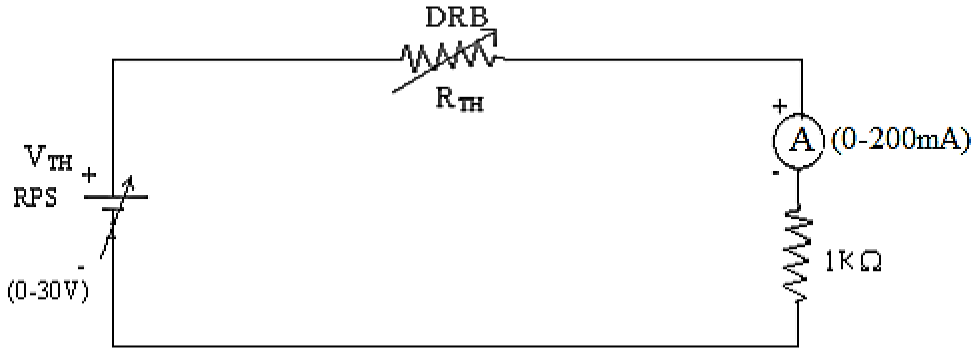
To find V_{TH}

3. Remove the load resistance and measure the open circuit voltage using multimeter (V_{TH}).

To find R_{TH}

4. To find the Thevenin’s resistance, remove the RPS and short circuit it and find the R_{TH} using multimeter.
5. Connect Thevenin’s equivalent circuit. Measure corresponding ammeter readings (I_L in equivalent circuit).

Thevenin's Equivalent circuit:



Tabular column:

<table>
<tr><th rowspan="2">Sl. No.</th><th rowspan="2">V_{in} (in Volts)</th><th colspan="2">Practical value</th><th colspan="2">I_L (in mA)</th></tr>
<tr><th>V_{TH} (in Volts)</th><th>R_{TH} (in Ω)</th><th>Circuit 1</th><th>Equivalent Circuit</th></tr>
<tr><td>1.</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Result: Thevenin’s theorem is verified.

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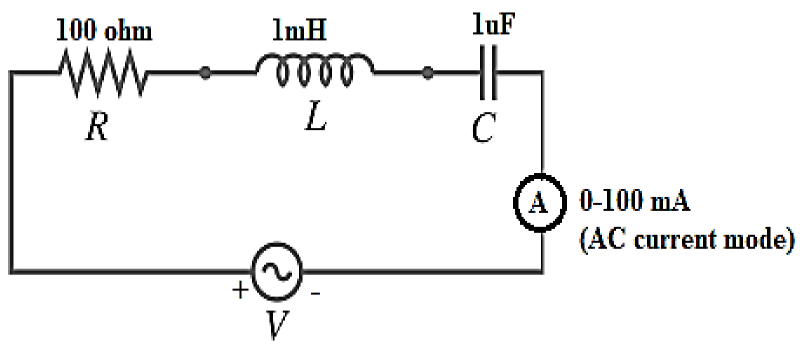
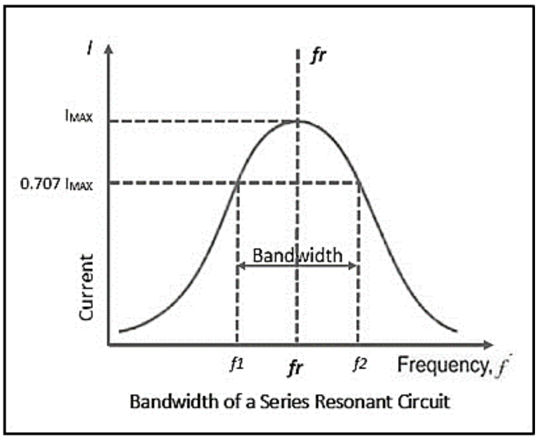
Expt. No.3 Date: ____________

Expt. Name: Construct series resonant ckt & plot its frequency response

Circuit diagram:



Graph:



Tabular column: $V_{in} = 5V$

Sl.No.	Frequency (in Hz)	Current (in mA)
1	100	
2	200	
3	300	
4	400	
5	500	
6	1K	
7	2K	
8	3K	
9	4K	
10	5K	
11	6K	
12	7K	
13	8K	
14	9K	
15	10K	

Formulas:

Resonance frequency, $\boxed{fr = {}^{1}/_{2\pi\sqrt{(LC)}}}$

$f_r =$ ________________ Hz

Expt. No. 3: Construct series resonant ckt & plot its frequency response

Aim: To plot frequency response of series resonant circuit.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	Signal generator		1
2	Digital Multimeter	------	1
3	Resistor	1KΩ	1
4	Capacitor	1µF	1
5	Inductor	1mH	1
6	Bread Board	-------	1

Theory:

Series resonance is a resonance condition that usually occurs in series circuits, where the current becomes a maximum for a particular voltage.

In **series resonance**, the current is maximum at resonant frequency.

The **series resonance** current curve increases to a maximum at resonance then decreases as resonance is passed.

Series resonance is a resonance condition that usually occurs in series circuits, where the current becomes a maximum for a particular voltage.

Procedure:

1. Connections are given as per the circuit diagram.
2. Keep the input voltage V_{in} =5V.
3. Vary the input frequency in steps and note down the corresponding current.
4. Plot the graph of Frequency Vs Current.

Result: Frequency response is plotted for series resonant circuit.

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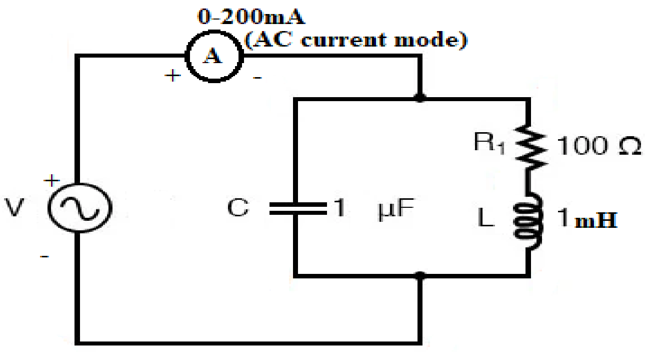
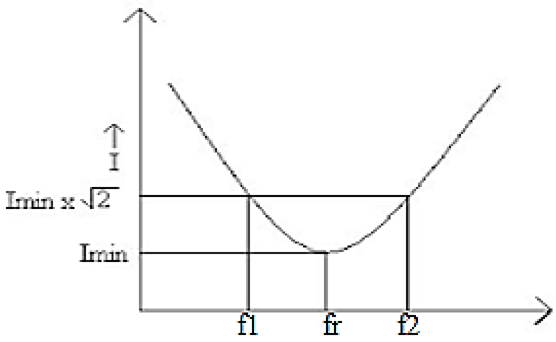
Expt. No.4 **Date: ____________**

Expt. No. 4: Construct parallel resonant ckt & its bandwidth & Q-factor

Circuit diagram:



Graph:



Tabular column: V_{in} =5V

Sl.No.	Frequency (in Hz)	Current (in mA)
1	100	
2	200	
3	300	
4	400	
5	500	
6	1K	
7	2K	
8	3K	
9	4K	
10	5K	
11	6K	
12	7K	
13	8K	
14	9K	
15	10K	

Formulas:

Bandwidth (BW) = $f_2 - f_1$ =_______ Hz Resonance frequency, $\boxed{fr = {}^{1}/_{2\pi\sqrt{(LC)}}}$

Q factor = f_r / BW = _______

Expt.No.4: Construct a parallel resonant ckt & its bandwidth & Q-factor

Aim: To find bandwidth and Q-factor for parallel resonance circuit.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	Signal generator		1
2	Digital Multimeter	------	1
3	Resistor	1KΩ	1
4	Capacitor	1µF	1
5	Inductor	1mH	1
6	Bread Board	-------	1

Theory:

Parallel resonance circuit has infinite impedance at resonance. Series resonance circuit has zero impedance at resonance.

Procedure:

1. Connections are given as per the circuit diagram.
2. Keep the input voltage V_{in} =5V.
3. Vary the input frequency in steps and note down the corresponding current.
4. Plot the graph of Frequency Vs Current.
5. Find bandwidth from graph using formula BW= $f_2 - f_1$.
6. Find Q-factor.

Result: Bandwidth and Q-factor of parallel resonant circuit are found.

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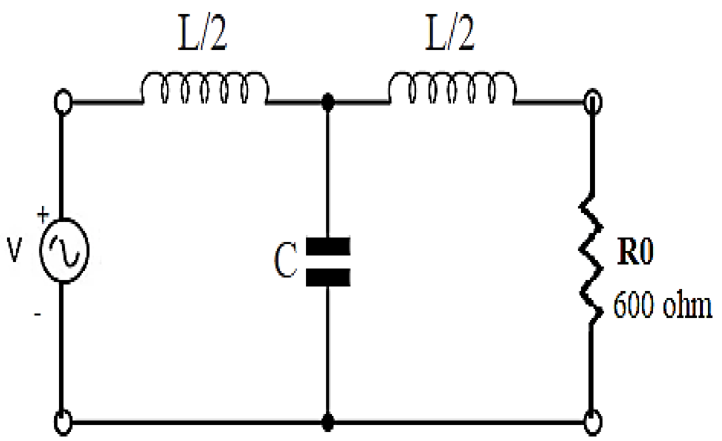
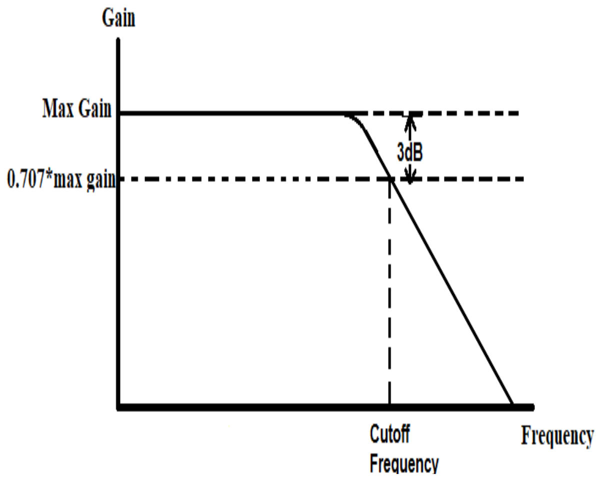
Expt. No.5 **Date: ____________**

Expt. No. 5: Construct and test the passive low-pass T-type filter circuit for a given cut-off frequency.

Circuit diagram:



Ideal Graph:



Tabular column: $V_{in} = 5V$

Sl.No.	Frequency (in Hz)	Output voltage Vo (in V)	Gain = $\frac{Vo}{Vin}$
1	100		
2	200		
3	300		
4	400		
5	500		
6	1K		
7	1.2K		
8	1.4K		
9	1.6K		
10	1.8K		
11	2K		
12	3K		

Expt. No. 5: Construct and test the passive low-pass T-type filter circuit for a given cut-off frequency.

Aim: To construct and test T type passive Low Pass Filter.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	Signal generator		1
2	Digital Multimeter	------	1
3	Resistor	600Ω	1
4	DIB	------	1
5	DCB	--------	1
6	Bread Board	-------	1

Theory:

Filter: A filter is a circuit capable of passing (or amplifying) certain frequencies while attenuating other frequencies.

LPF: Low Pass Filter is a filter which passes all the frequencies below cut-off frequency and attenuates frequency above fc.

Procedure:

1. Connections are given as per the circuit diagram.
2. Keep the input voltage V_{in} =5V.
3. Vary the input frequency in steps and note down the corresponding output voltage.
4. Calculate the gain
5. Plot the graph of Frequency Vs Gain.

Calculation:

Given cut off frequency fc= 2KHz and characteristic impedance R_0 = 600Ω

We know that for LPF,

$L = \frac{Ro}{\pi f c}$ $C = \frac{1}{\pi f c\ Ro}$

L = _______ mH C = _____________ μF

L/2 = __________mH

Result: T type passive Low Pass Filter is constructed and tested.

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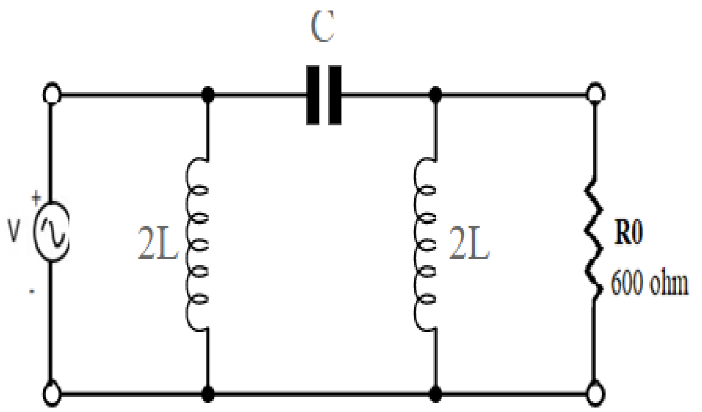
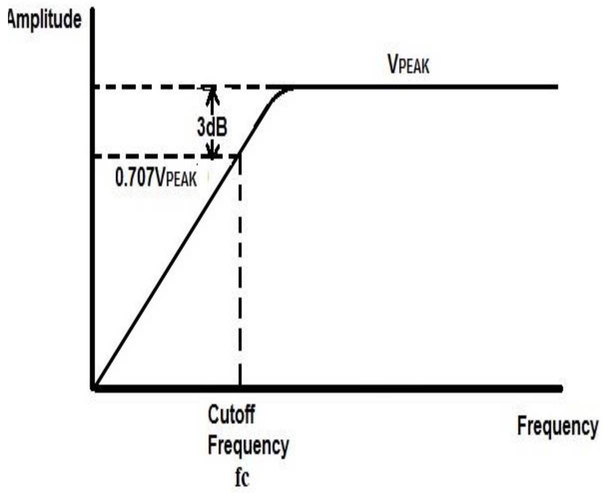
Expt. No.6 **Date: ____________**

Expt. Name. 6: Construct and test the passive HIGH-pass PI-type filter circuit for a given cut-off frequency.

Circuit diagram:



Ideal Graph:



Tabular column: V_{in} **=5V**

Sl.No.	Frequency (in Hz)	Output voltage Vo (in V)	Gain = $\frac{Vo}{Vin}$
1	100		
2	200		
3	400		
4	500		
5	1K		
6	1.2K		
7	1.4K		
8	1.6K		
9	1.8K		
10	2K		
11	3K		
12	4K		

Expt. No. 6: Construct and test the passive high-pass pi-type filter circuit for a given cut-off frequency.

Aim: To construct and test π type passive High Pass Filter.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	Signal generator		1
2	Digital Multimeter	------	1
3	Resistor	600Ω	1
4	DIB	------	1
5	DCB	--------	1
6	Bread Board	-------	1

Theory:

Filter: A filter is a circuit capable of passing (or amplifying) certain frequencies while attenuating other frequencies.

HPF: Low Pass Filter is a filter which passes all the frequencies above cut-off frequency and attenuates frequency below fc.

Procedure:

1. Connections are given as per the circuit diagram.
2. Keep the input voltage V_{in} =5V.
3. Vary the input frequency in steps and note down the corresponding output voltage.
4. Calculate the gain
5. Plot the graph of Frequency Vs Gain.

Calculation:

Given cut off frequency fc= 2KHz and characteristic impedance R_0 = 600Ω

We know that for LPF,

$L = \frac{Ro}{4\pi f c}$ $C = \frac{1}{\pi f c \ Ro}$

L = _______ mH C = ____________ µF

2L = _________mH

Result: π type passive High Pass Filter is constructed and tested.

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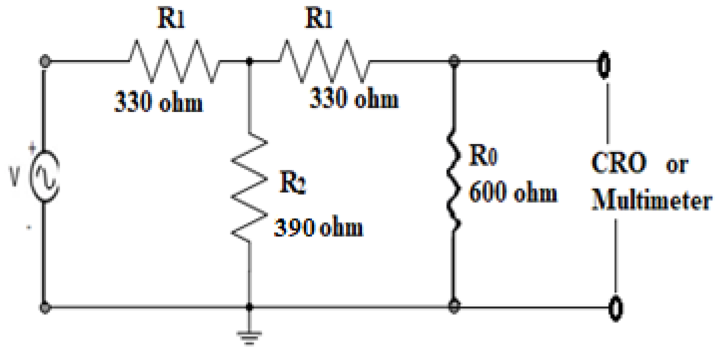
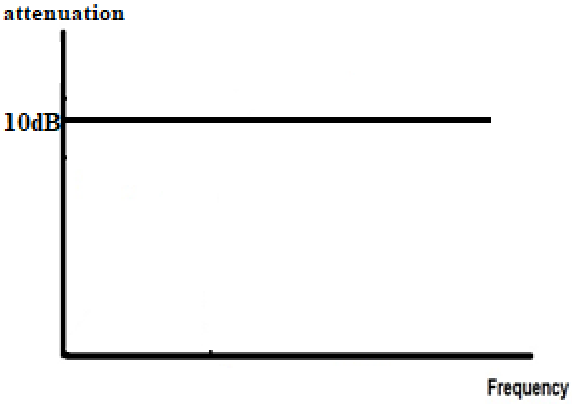
Expt. No.7 **Date: ____________**

Expt. No. 7: Construct and test t-type attenuator circuit for given attenuation and R_0

Circuit diagram:



Ideal Graph:



Tabular column: V_{in} =5V

Sl.No.	Frequency (in Hz)	Output voltage Vo (in V)	Attenuation=20 log($\frac{Vin}{Vo}$) (in dB)
1	100		
2	200		
3	400		
4	500		
5	1K		
6	2K		
7	3K		
8	4K		
9	5K		
10	6K		
11	7K		
12	8K		

Expt. No. 7: Construct and test t-type attenuator circuit for given attenuation and R_0

Aim: To construct and test T type attenuator for attenuation of 10dB and R_0= 600Ω.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	Signal generator		1
2	Digital Multimeter	------	1
3	Resistor	600Ω,	1
4	Bread Board	-------	1

Theory:

An attenuator is a 4 terminal network used to reduce the amplitude of a signal passing through it.

Procedure:

1. Connections are given as per the circuit diagram.
2. Keep the input voltage V_{in} =5V.
3. Vary the input frequency in steps and note down the corresponding output voltage.
4. Calculate the attenuation.
5. Plot the graph of Frequency Vs attenuation.

Design:

Given attenuation=10dB and characteristic impedance R_0 = 600Ω

We know that, attenuation in dB = 20log(N)

N= antilog (10/20) = 3.16

$R_1 = [(N-1)/(N+1)]\ R_0$

$R_1 = [(3.16-1)/(3.16+1)]\ *600$

$\underline{R_1 = 311.53\ \Omega\ \approx 330\Omega}$

$R_2 = [2N/(N^2-1)]\ R_0$

$R_2 = [(2*3.16)\ /(3.16^2-1)]\ *600$

$\underline{R_2 = 422\ \Omega\ \approx 390\Omega}$

Result: T type attenuator is constructed and tested.

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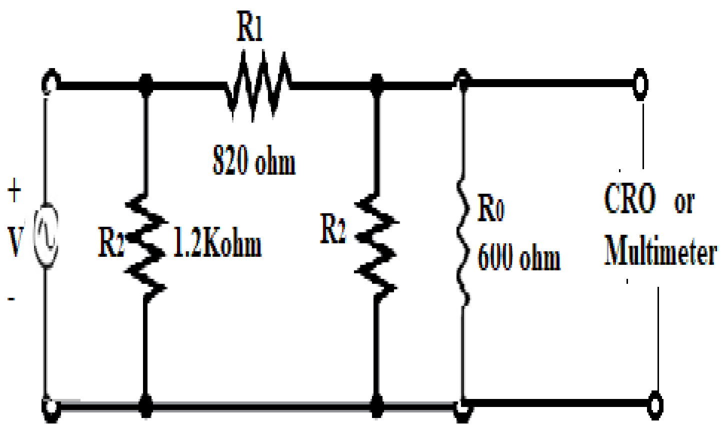
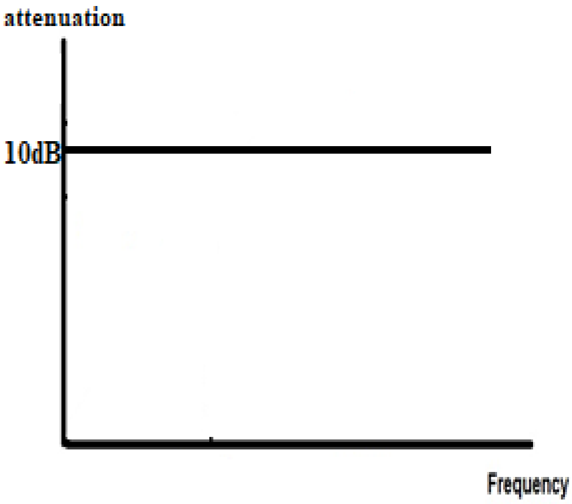
Expt. No.8 **Date: ____________**

Expt No. 8: Construct and test pi-type attenuator circuit for given attenuation and R_0

Circuit diagram:



Ideal Graph:



Tabular column: $V_{in} = 5V$

Sl.No.	Frequency (in Hz)	Output voltage Vo (in V)	Attenuation=20 log($\frac{Vin}{Vo}$) (in dB)
1	100		
2	200		
3	400		
4	500		
5	1K		
6	2K		
7	3K		
8	4K		
9	5K		
10	6K		
11	7K		
12	8K		

Expt. No. 8: Construct and test pi-type attenuator circuit for given attenuation and R_0

Aim: To construct and test T type attenuator for attenuation of 10dB and R_0= 600Ω.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	Signal generator		1
2	Digital Multimeter	------	1
3	Resistor	600Ω,	1
4	Bread Board	-------	1

Theory:

An attenuator is a 4 terminal network used to reduce the amplitude of a signal passing through it.

Procedure:

1. Connections are given as per the circuit diagram.
2. Keep the input voltage V_{in} =5V.
3. Vary the input frequency in steps and note down the corresponding output voltage.
4. Calculate the attenuation.
5. Plot the graph of Frequency Vs attenuation.

Design:

Given attenuation=10dB and characteristic impedance R_0 = 600Ω

We know that, attenuation in dB = 20log (N)

N= antilog (10/20) = 3.16

$R_1 = [(N^2 - 1)/2N]\ R_0$

$R_1 = [(3.16^2 - 1)/(2*3.16)] * 600$

$R_1 = 853\Omega \approx 820\Omega$

$R_2 = [(N+1)/(N-1)]\ R_0$

$R_2 = [(3.16+1)/(3.16-1)] * 600$

$R_2 = 1.55K\ \Omega \approx 1.2K\Omega$

Result: π type attenuator is constructed and tested.

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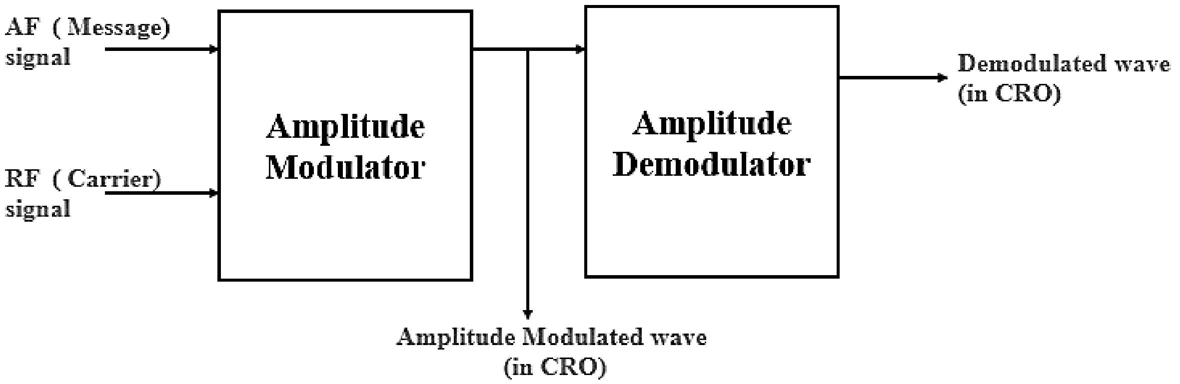
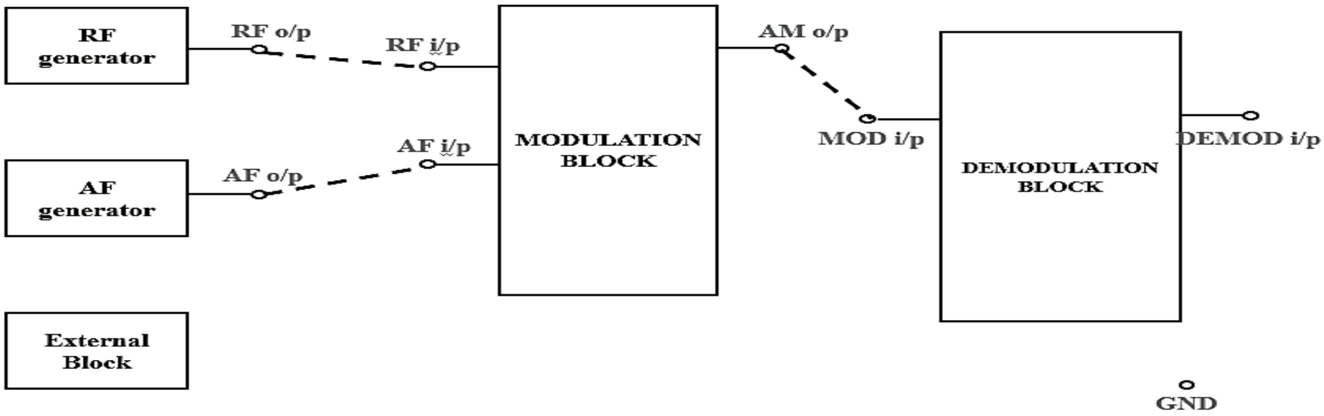
Expt. No.9 **Date: ____________**

Expt. No.9: Amplitude modulation and demodulation

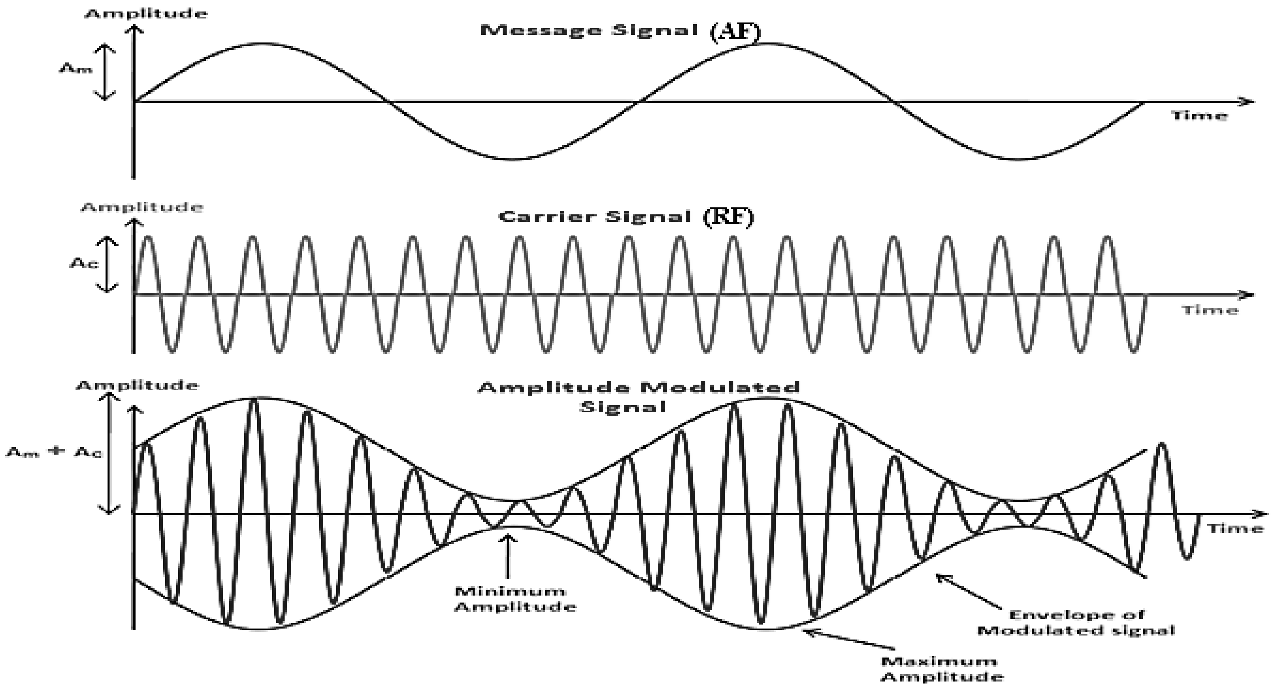
Amplitude Modulation and Demodulation block diagram:



Connection in kit:



Waveforms:



Expt No.9: Amplitude modulation and demodulation

Aim: To study AM modulator and demodulator to verify the AM waveform.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	AM kit		1
2	CRO	------	1
3	Patch cords and probes		

Theory:

Introduction to modulation:

The message to be transmitted is called message signal or modulating signal.

The signal which carriers the message along with it is called carrier signal.

Carrier frequency < message frequency.

Modulation: is a process of changing some parameters of carrier.

Amplitude modulation: AM is a modulation technique, in which amplitude of the carrier signal changes with respect to amplitude message (AF) signal ,keeping frequency constant.

Modulation index, $\mathbf{m} = \frac{Am}{Ac}$

Where, Am→ maximum amplitude of message (AF) signal

Ac→ maximum amplitude of carrier (RF) signal

Modulation index is always **0>m>1.** When m>1, carrier is over modulated and it message signal can't be ideally reconstructed.

Procedure:

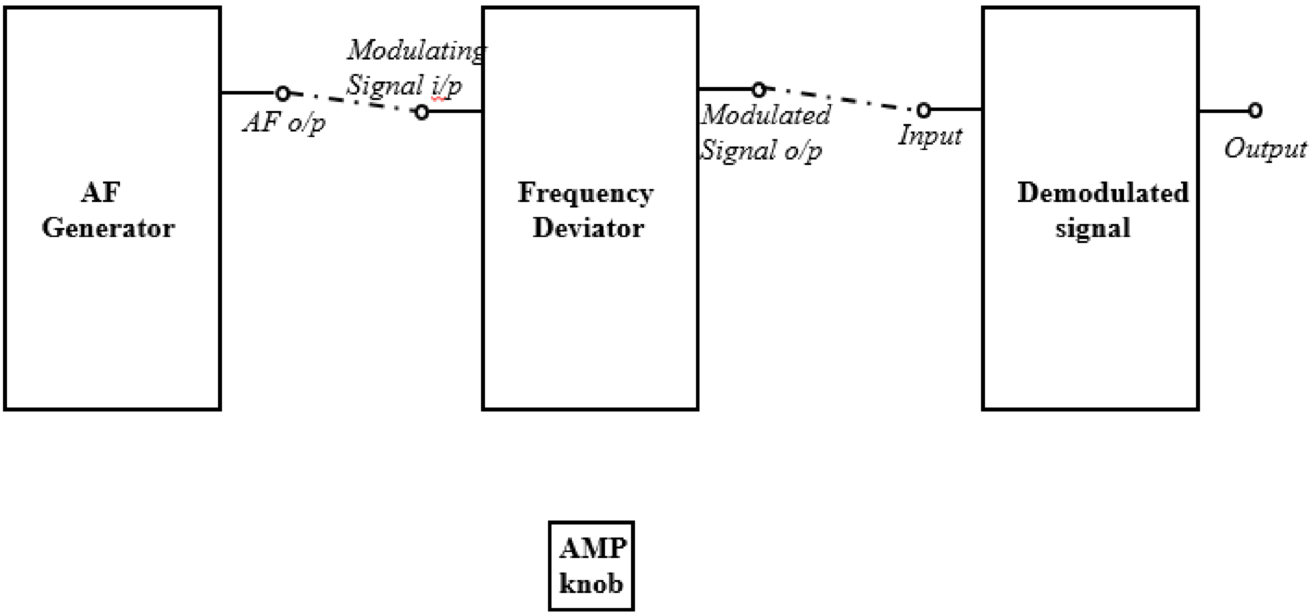
1. Connect the trainer kit to the mains supply and switch ON.
2. Observe the modulating (AF) output and carrier (RF) output by varying knob.
3. Connect AF and RF output corresponding inputs of modulator block.
4. Observe modulated output on CRO (CH1) and AF on CRO (CH2).
5. Connect AM output to Demodulation block.
6. Observe demodulated output on CRO.

Result:

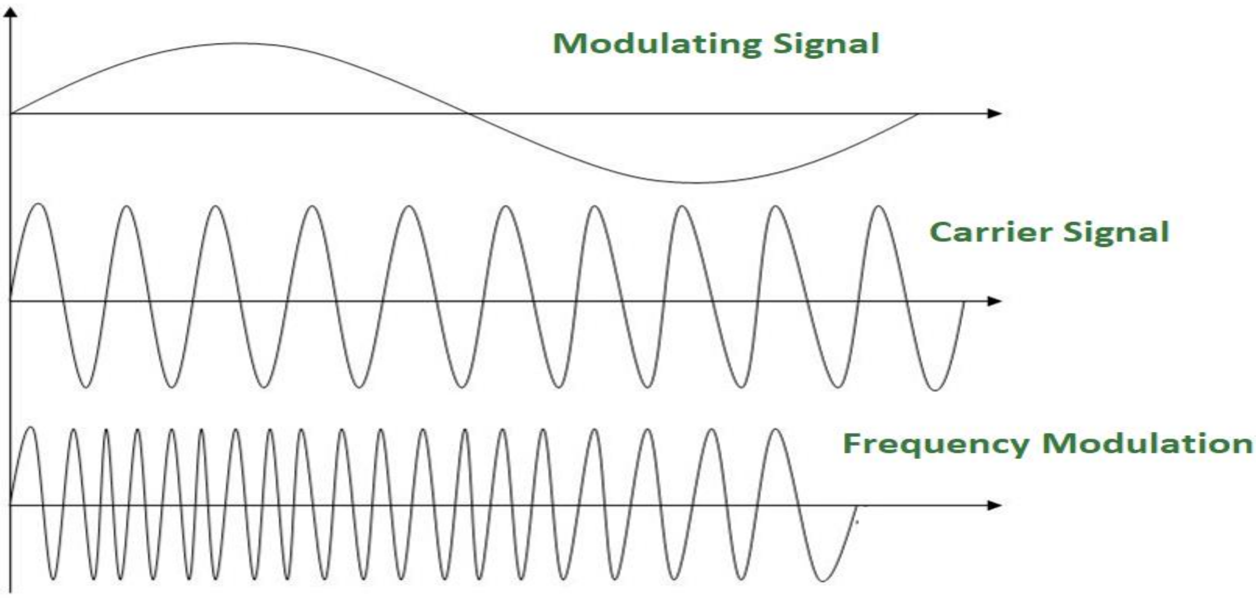
Working of AM modulator and Demodulator is studied.

EXPT NO.10: FREQUENCY MODULATION AND DEMODULATION

Connection in kit:



Waveforms:



EXPT NO.10: FREQUENCY MODULATION AND DEMODULATION

Aim: To study FM modulator and demodulator to verify the FM waveform.

Apparatus Required:

Sl.No.	Component	Specifications	Quantity
1	FM kit		1
2	CRO	------	1
3	Patch cords and probes		

Theory:

Introduction to modulation:

The message to be transmitted is called message signal or modulating signal.

The signal which carriers the message along with it is called carrier signal.

Carrier frequency < message frequency.

Modulation: is a process of changing some parameters of carrier.

Frequency modulation: FM is a modulation technique, in which frequency of the carrier signal changes with respect to amplitude message signal, keeping amplitude constant.

Procedure:

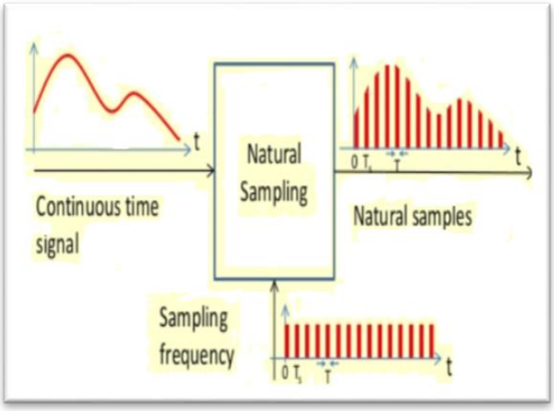
1. Connect the trainer kit to the mains supply and switch ON.
2. Observe the modulating (AF) output.
3. Connect AF to modulating input of modulator block.
4. Observe modulated output on CRO (CH1) and AF on CRO (CH2) by varying AMP knob.
5. Connect modulated signal output to input of Demodulator block.
6. Observe demodulated output on CRO.

Result:

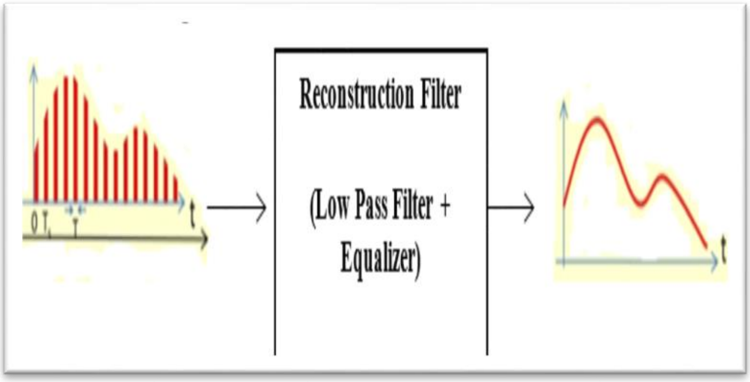
Working of FM modulator and Demodulator is studied.

EXPT NO.11: SAMPLING THEOREM FOR LOW PASS FILTER

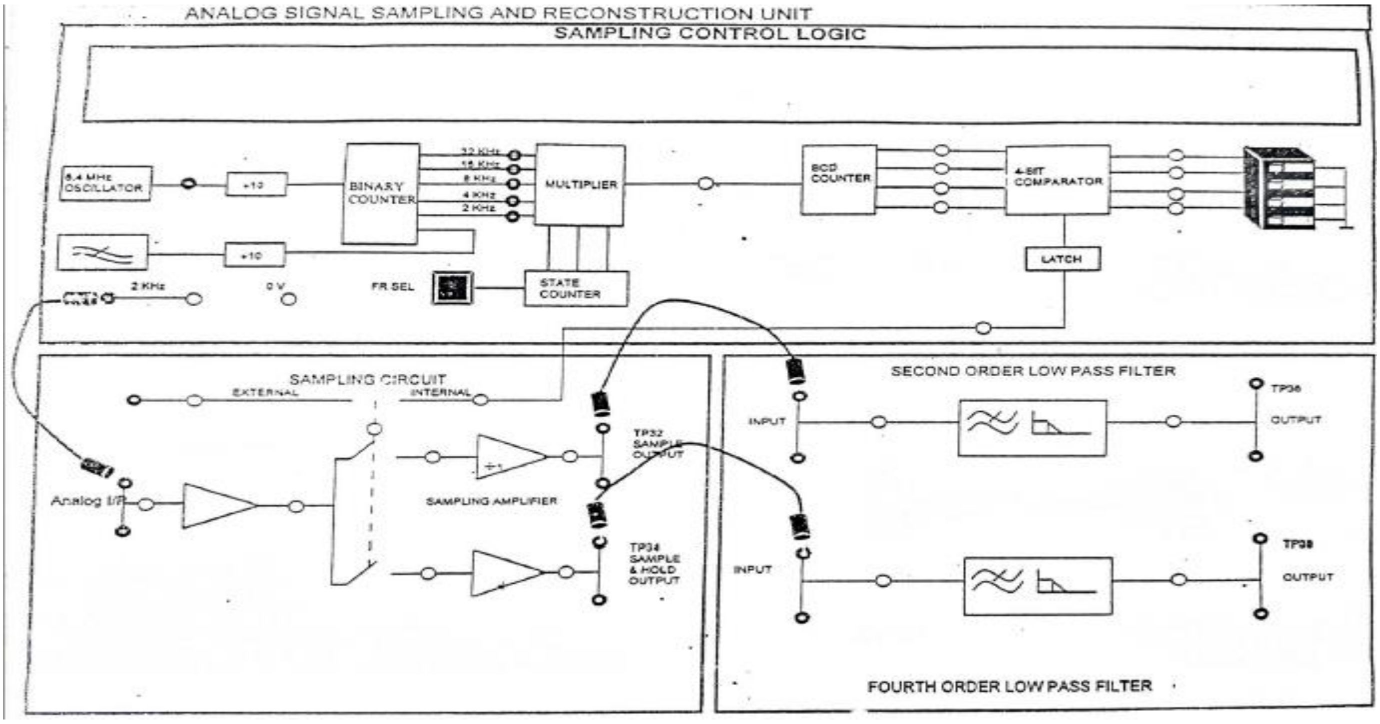
Sampling of signal:



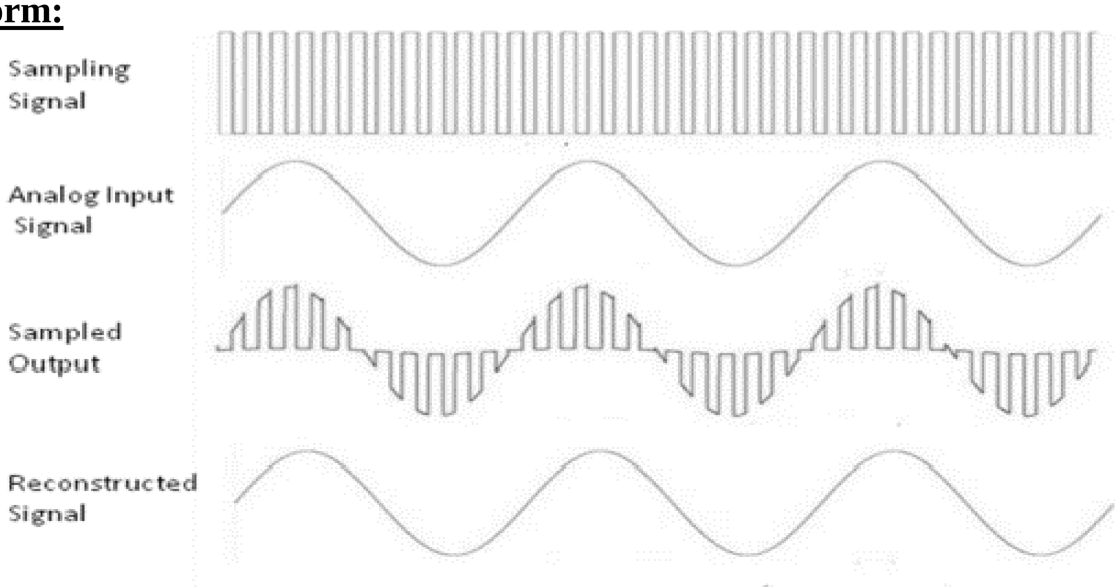
Reconstruction of signal:



Connection in kit:



Waveform:



EXPT NO.11: SAMPLING THEOREM FOR LOW PASS FILTER

Aim: To prove sampling theorem for low pass filter

Apparatus Required:

Sl.No.	Equipment	Quantity
1	Sampling Theorem Trainer kit	1
2	Oscilloscope	1
3	Power Supply	1
4	Probes	As per requirement
5	Patch cords	As per requirement

Theory:

Sampling is the process of converting analog signal to discrete signal.

Sampling theorem: "It states the conversion of analog signal into a discrete form by taking the sampling frequency (F_s) as twice the input frequency (F_m)"

$$\mathbf{F_s >= 2\ F_m}$$

Where, $\mathbf{F_s}$ is the sampling frequency

$\mathbf{F_m}$ is the maximum frequency of the analog signal

Procedure:

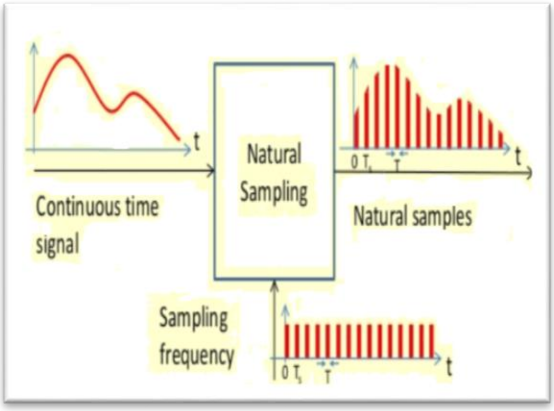
1. Connect the power supply cable at the Power In connector.
2. Connect the 2 KHz from signal generator to the analog input on the kit.
3. Observe the sampled output.
4. Change the sampling frequency from 2 KHz to 32 KHz by using the sampling frequency switch and observe the waveforms.
5. Observe sampled and hold output at the respective point.
6. Observe the reconstructed signal at the fourth order low pass filter.

Result:

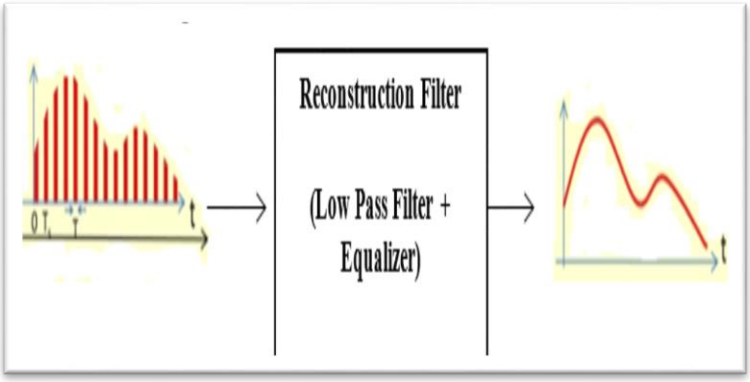
The Sampling Theorem is verified.

EXPT NO.12: STUDY OF ALIASING EFFECT

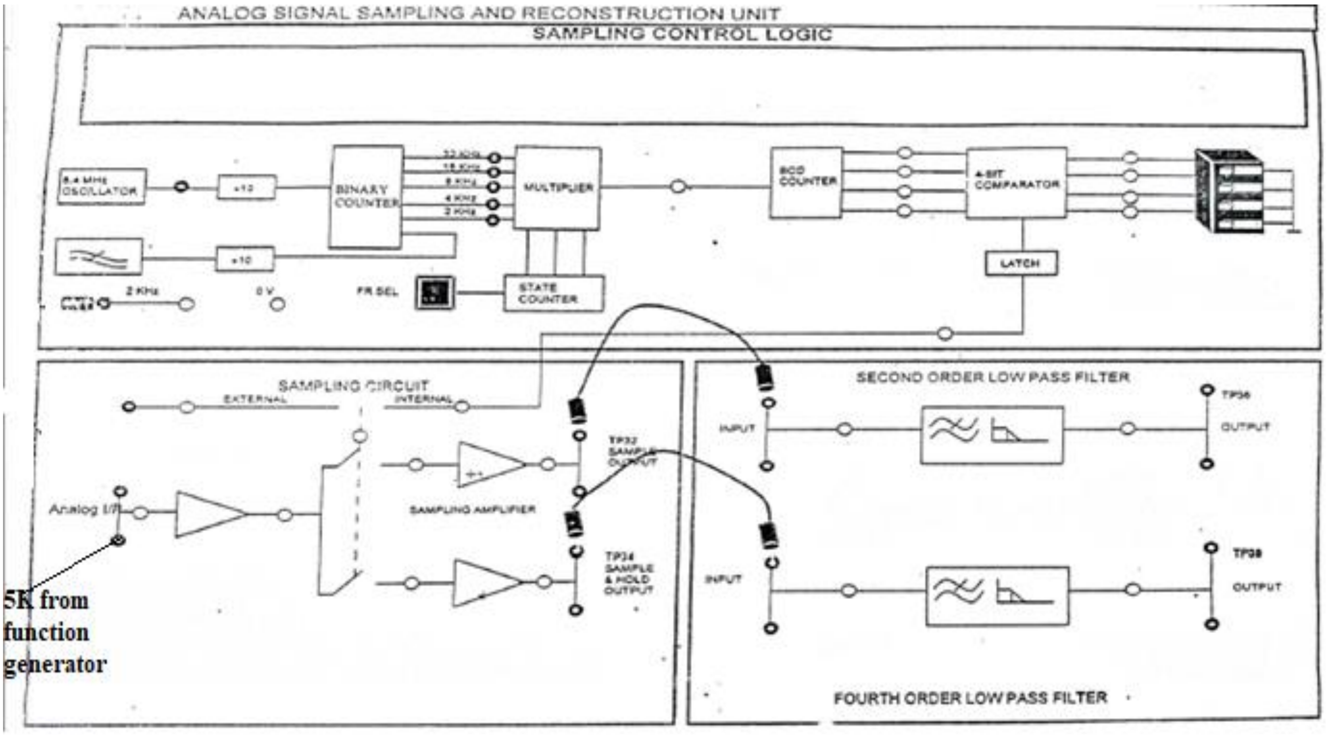
Sampling of signal:



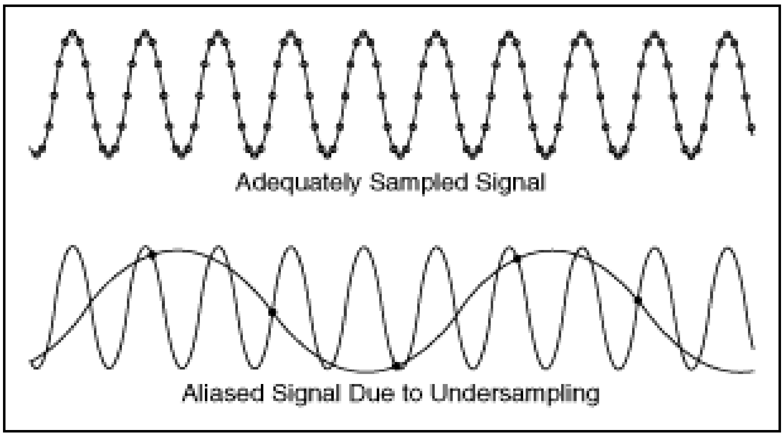
Reconstruction of signal:



Connection in kit:



Waveform:



EXPT NO.12: STUDY OF ALIASING EFFECT

Aim: To study aliasing affect.

Apparatus Required:

Sl.No.	Equipment	Quantity
1	Sampling Theorem Trainer kit	1
2	Oscilloscope	1
3	Power Supply	1
4	Probes	As per requirement
5	Patch cords	As per requirement

Theory:

Sampling is the process of converting analog signal to discrete signal.

Sampling theorem: "It states the conversion of analog signal into a discrete form by taking the sampling frequency (F_s) as twice the input frequency (F_m)"

$$\mathbf{F_s >= 2\,F_m}$$

Where, $\mathbf{F_s}$ is the sampling frequency

$\mathbf{F_m}$ is the maximum frequency of the analog signal

If the sampling rate $fs < 2\ fm$, then the sidebands of the signal overlap and message *signal* cannot be recovered without distortion. The overlapping of sideband is called as ***aliasing***.

Procedure:

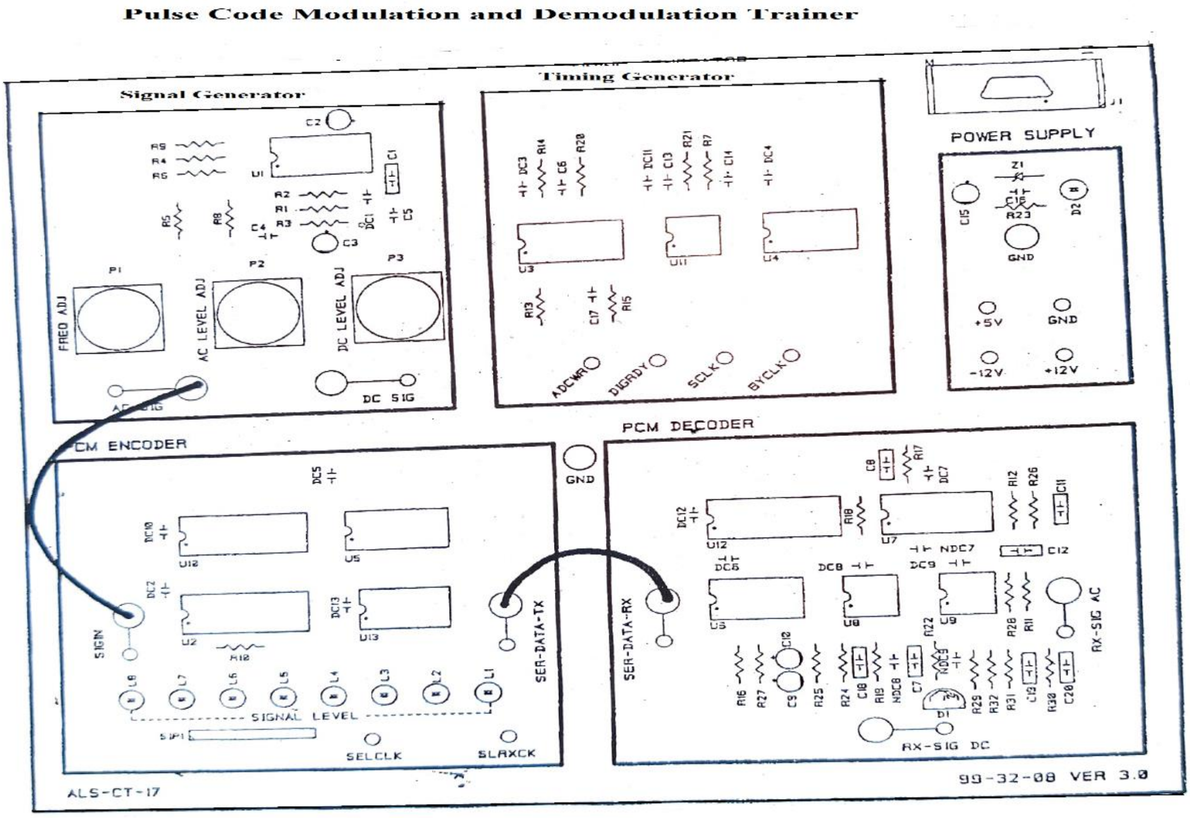
1. Connect the power supply cable at the Power In connector.
2. Connect the 5 KHz from signal from signal generator to the analog input on the kit.
3. Observe the sampled output.
4. Change the sampling frequency from 2 KHz to 8 KHz by using the sampling frequency switch and observe the waveforms.
5. Observe sampled and hold output at the respective point.
6. Observe the reconstructed signal at the fourth order low pass filter.

Result:

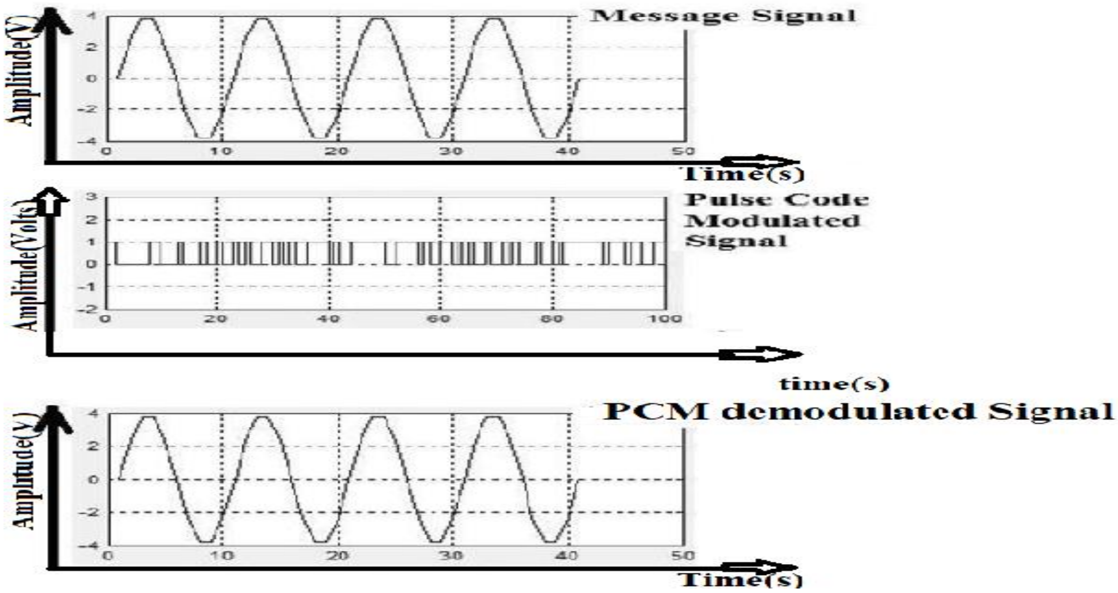
The aliasing effect is verified.

EXPT NO.13: STUDY OF PULSE CODE MODULATION & DEMODULATION

Connection in kit:



Waveform:



EXPT NO.13: STUDY OF PULSE CODE MODULATION & DEMODULATION

Aim: To study pulse code modulation (PCM) and demodulation using kit.

Apparatus Required:

Sl.No.	Equipment	Quantity
1	PCM Trainer kit	1
2	Oscilloscope	1
3	Power Supply	1
4	Probes	As per requirement
5	Patch cords	As per requirement

Theory:

Pulse code modulation is an extension of PAM wherein each analog sample value is quantized into a discrete value.

In the PCM system, the message signal is sampled and the amplitude of each sample is rounded off (quantized) to the nearest discrete level. Therefore, both time and amplitude are represented in the discrete form.

Procedure:

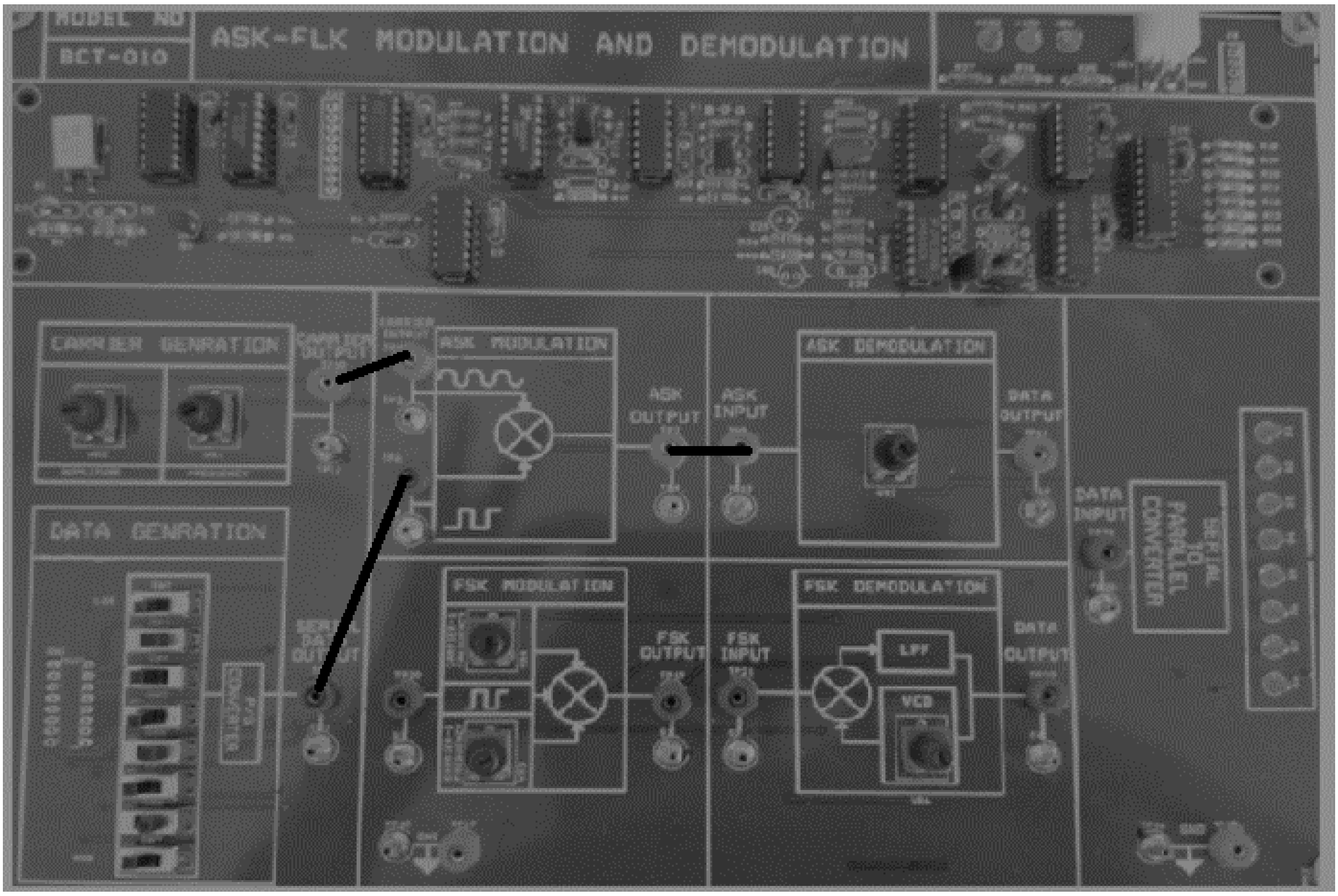
1. Connect the power supply cable at the Power In connector.
2. Connect the 5 KHz from signal from signal generator to the analog input on the kit.
3. Observe the sampled output.
4. Change the sampling frequency from 2 KHz to 8 KHz by using the sampling frequency switch and observe the waveforms.
5. Observe sampled and hold output at the respective point.
6. Observe the reconstructed signal at the fourth order low pass filter.

Result:

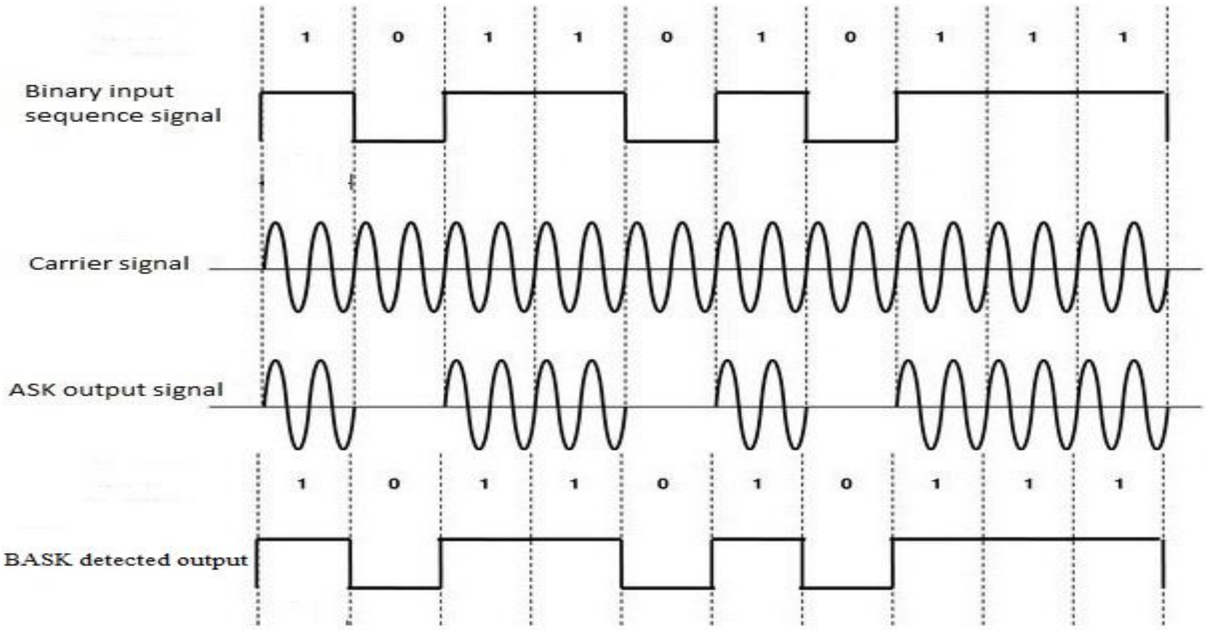
Pulse Code modulation and demodulation are verified in the Kit and its waveforms are studied

EXPT NO.14: STUDY OF GENERATION & DETECTION OF BASK

Connection in kit:



Waveform:



EXPT NO.14: STUDY OF GENERATION & DETECTION OF BASK

Aim: To study generation and detection of BASK using kit.

Apparatus Required:

Sl.No.	Equipment	Quantity
1	BASK Trainer kit	1
2	Oscilloscope	1
3	Power Supply	1
4	Probes	As per requirement
5	Patch cords	As per requirement

Theory:

The BASK (Binary Amplitude Shift Keying) system was one of the earliest form of digital modulation used in wireless telegraphy. In a BASK system binary symbol ‘1’ is represented by transmitting a sinusoidal carrier wave of fixed amplitude and fixed frequency and binary symbol ‘0’ is represented by switching sinusoidal carrier wave of amplitude of 0.

Procedure:

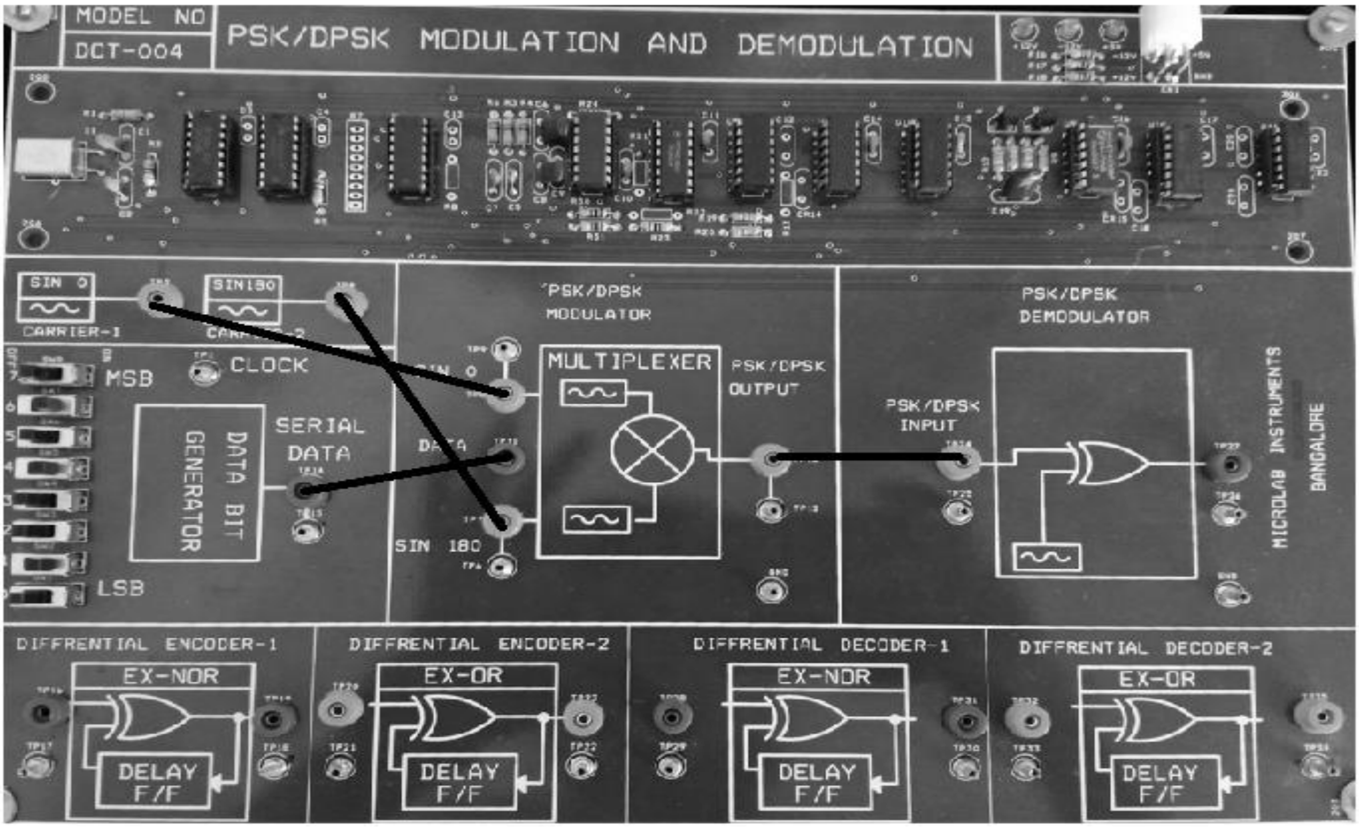
1. Connect the power supply to the kit and & switch it on.
2. Set the amplitude and frequency of the carrier wave as desired.
3. Connect CARRIER output to CARRIER input of ASK modulator.
4. Set the serial data bit in data generation and connect SERIAL DATA OUTPUT to SERIAL DATA INPUT in modulator.
5. Observe the following waveforms on CRO
   i. Message data
   ii. Carrier signal
   iii. ASK modulator output
6. ASK OUTPUT from modulator to ASK INPUT of demodulator.
7. Observe demodulator output at CRO.

Result:

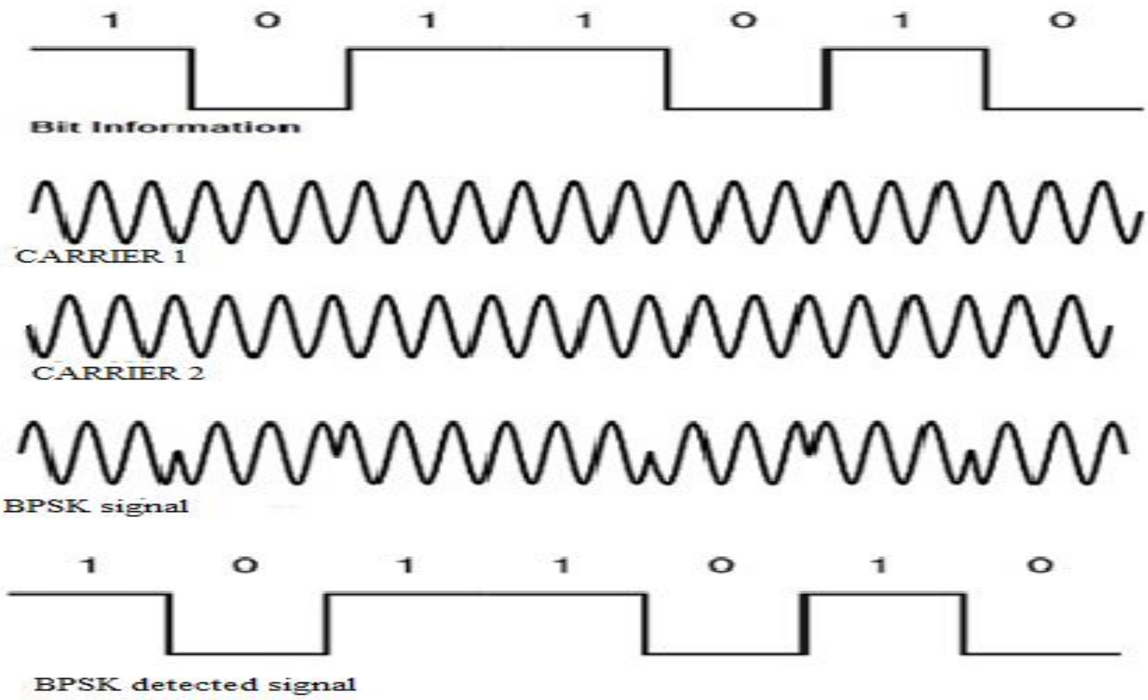
BASK signal is generated and detected for given serial data

EXPT NO.15: STUDY OF GENERATION & DETECTION OF BPSK

Connection in kit:



Waveform:



EXPT NO.15: STUDY OF GENERATION & DETECTION OF BPSK

Aim: To study generation and detection of BPSK using kit.

Apparatus Required:

Sl.No.	Equipment	Quantity
1	BPSK Trainer kit	1
2	Oscilloscope	1
3	Power Supply	1
4	Probes	As per requirement
5	Patch cords	As per requirement

Theory:

The BPSK (Binary Phase Shift Keying) is a modulation/data transmitting technique in which phase of the Carrier signal is shifted between two distinct levels.
In a PSK un-shifted CARRIER 1 is transmitted to indicate a 1 condition, and the CARRIER 2 (CARRIER 1 shifted by 180^0) is transmitted to indicate as 0 condition.

Procedure:

1. Connect the power supply to the kit and & switch it on.
2. Connect CARRIER-1 to SIN 0 and CARRIER-2 to SIN 180 input of DPSK modulator.
3. Set the serial data bit in data generation and connect SERIAL DATA to DATA input of modulator.
4. Observe the following waveforms on CRO
   i. Message data
   ii. DPSK output
5. Connect DPSK output from modulator to DPSK input of demodulator.
6. Observe demodulator output at CRO.

Result:

BPSK signal is generated and detected for given serial data