EXPERIMENT NO-1

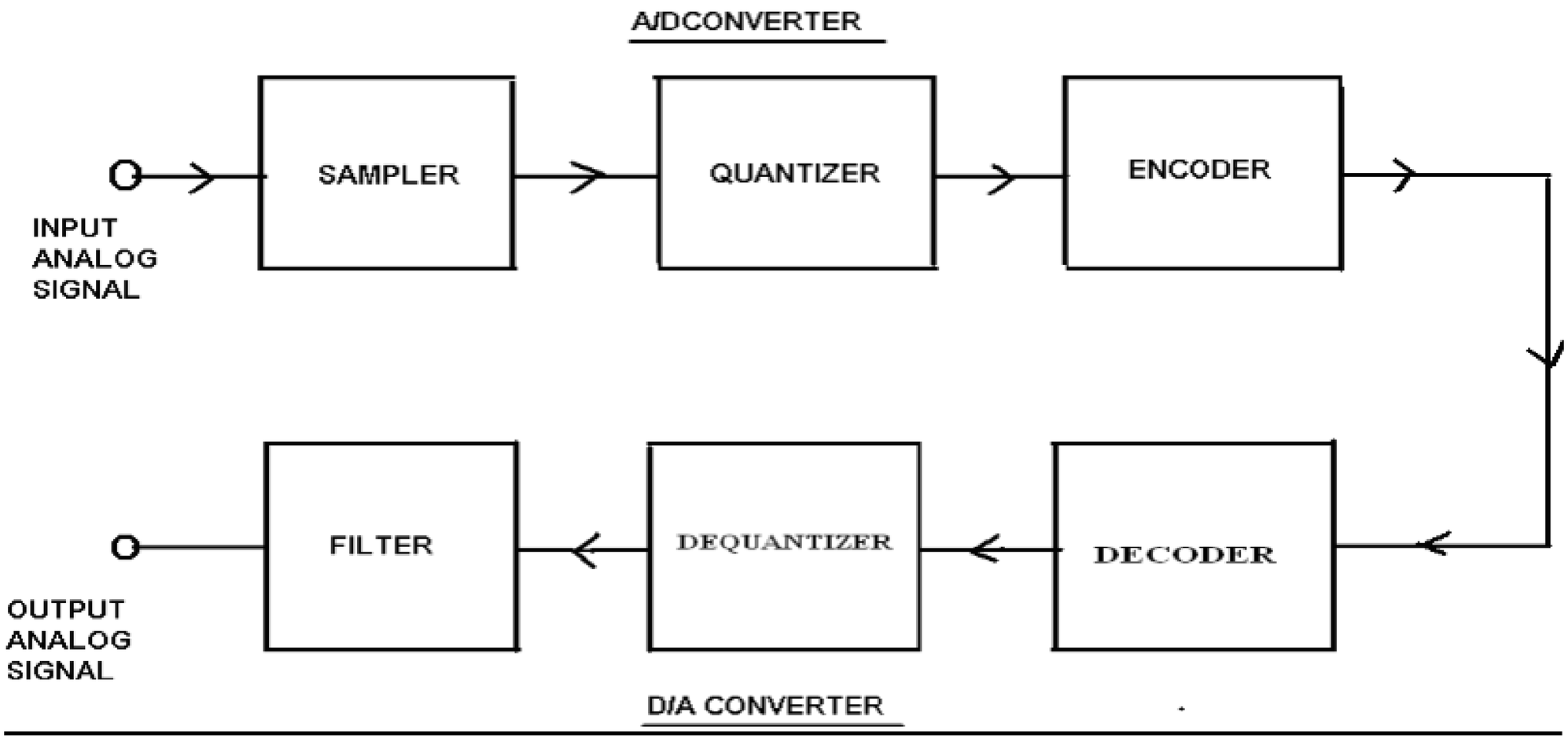
PULSE CODE MODULATION & DEMODULATION

Aim: Test the performance of PCM generation and demodulation of analog signal.

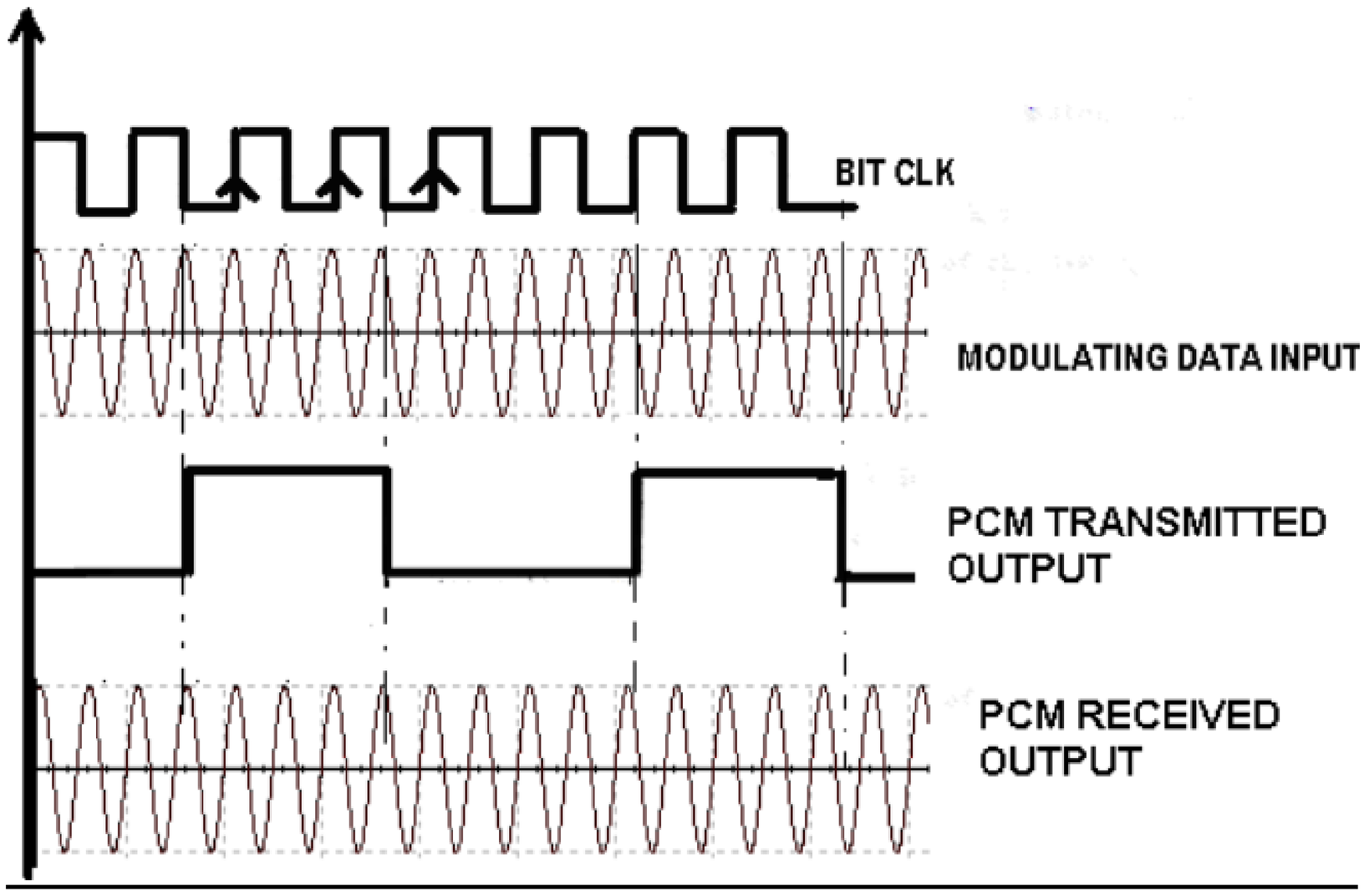
Apparatus:
1. PCM transmitter trainer.
2. PCM receiver trainer.
3. CRO and connecting wires.

Theory:
In the PCM communication system, the input analog signal is sampled and these samples are subjected to the operation of quantization. The quantized samples are applied to an encoder. The encoder responds to each such a sample by generation unique and identifiable binary pulse. The combination of quantize and encoder is called analog to digital converter. It accepts analog signal and replaces it with a successive code symbol, each symbol consists of a train of pulses in which the each pulse represents a digit in arithmetic system.

Block Diagram:



Output Waveform:



Procedure:

1. The two inputs of function generator are connected to channel -0 and channel-1 simultaneously that is DC1 output to channel -0 and DC2 to channel-1.
2. With the help of oscillator DC1 output is adjusted to 0 volts.
3. Transmitter and receiver are connected by the synchronization of clock pulses and by connecting ground transmitter to ground receiver.
4. The transmitter is connected to the input of receiver to go the original signal at the receiver output.
5. After connection is made the inputs channel 1 and channel 0 are noted. The sampled output of bit channels are taken by connecting DC1 output to channel 0 and DC2 output to channel-1.
6. The phase shift of a channel can be obtained by comparing the input and output of channels at the transmitter block.
7. Thus the output of transmitter can be noted down and input of receiver is similar to that.
8. The receiver output signals are noted down at channel 0 and channel 1 of the receiver block.

Result:

Performance of PCM Generation and demodulation of analog signal is observed.

EXPERIMENT NO-2

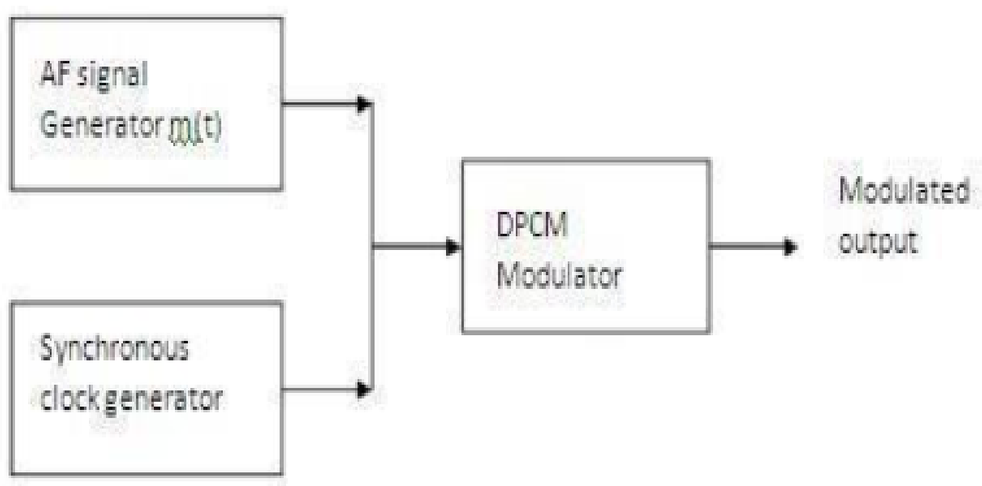
DIFFERENTIAL PULSE CODE MODULATION

Aim: Test the performance of PCM generation and demodulation of analog signal.

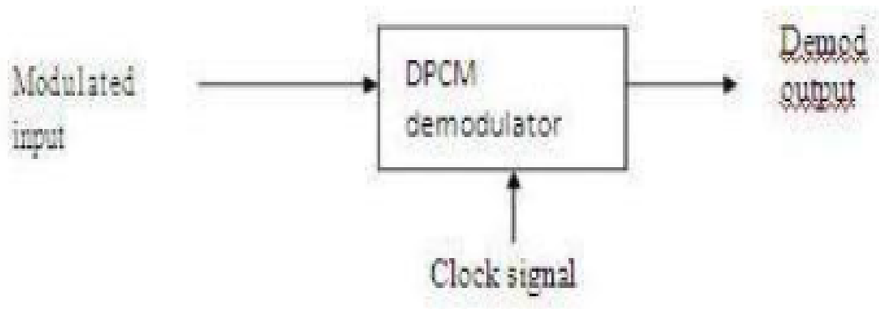
Apparatus:
1. DPCM Trainer kit
2. Patch cards
3. CRO- (0-20MHz)
4. AC Adapter (± 8V)
5. CRO Probes.

Theory:
In Differential Pulse Code Modulation (DPCM), instead of quantizing each sample, the difference between the two successive samples is quantized, encode, and transmitted as in the PCM. This particularly useful in the Voice communication, because in this case two successive samples do not differ much in amplitude.
Thus, the difference signal is much less in amplitude than the actual sample and, hence, less number of quantization levels is needed. Therefore, the number of bits per code is reduced, resulting in a reduced bit rate. Thus, the band width required in this case is less than the one required in PCM.
The disadvantage of DPCM is that the modulator and demodulator circuits are more complicated than those in PCM.

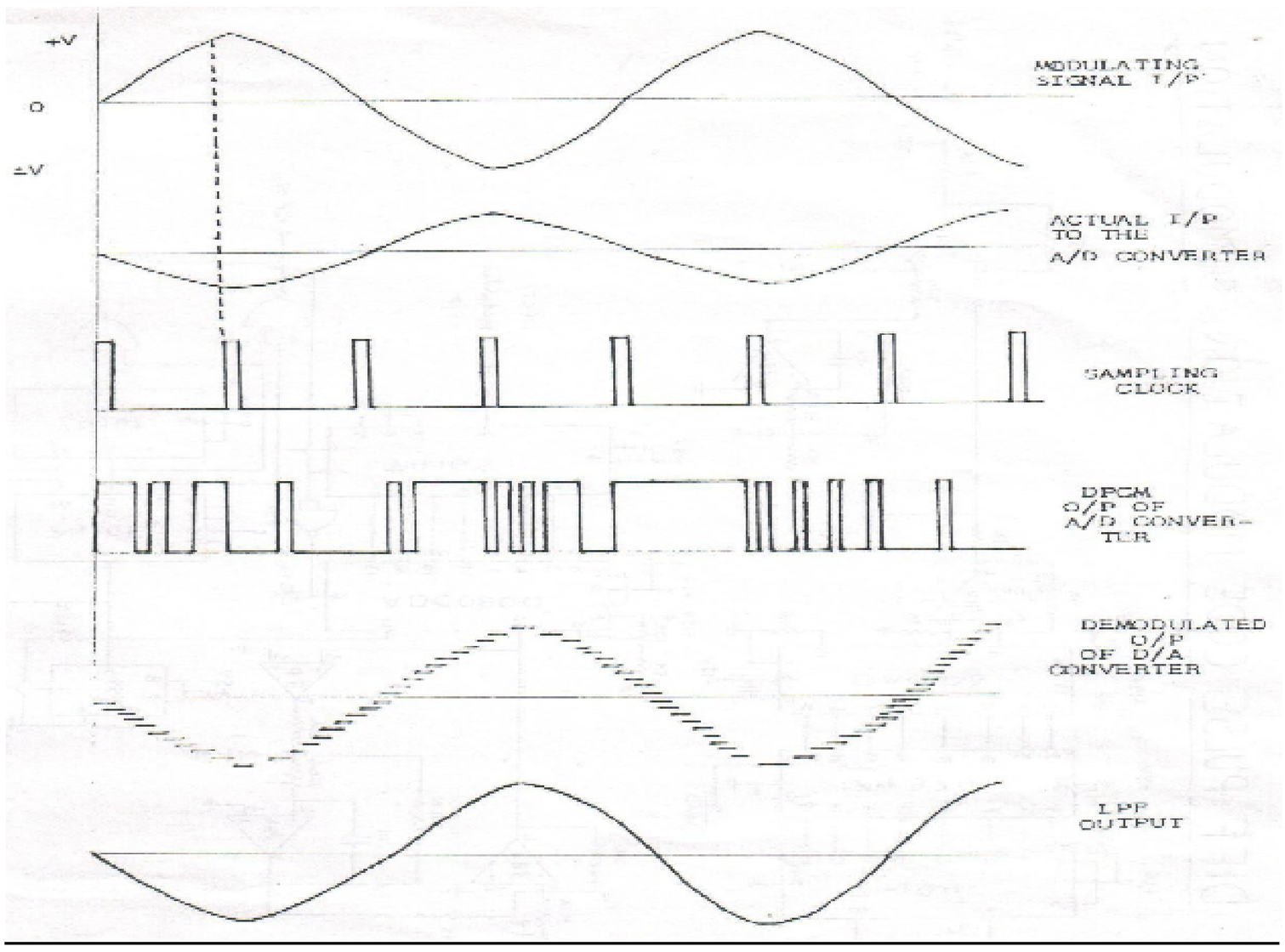
DPCM MODULATOR



DPCM DEMODULATOR



Model Waveforms:



Procedure:

1. Switch on the Kit.
2. Apply the variable DC signal to the input terminals of DPCM modulator.
3. Observe the sampling signal output on CRO
4. Observe the output of DPCM on the second channel of CRO
5. By adjusting the DC voltage potentiometer we can get the DPCM output from 0000 0000 to 1111 1111.
6. Now, disconnect the DC voltage and apply AF oscillator output to the input of the DPCM modulator
7. observe the output of conditioning amplifier (differential output) and DPCM outputs in synchronization with the sampling signal.
8. During demodulation, connect DPCM output to the input of demodulation and observe the output of Demodulator

Result:

Performance of DPCM Generation and demodulation of analog signal is observed.

EXPERIMENT NO-3

DELTA MODULATION & DEMODULATION

Aim:
Test the performance of the Delta modulation.

Apparatus:

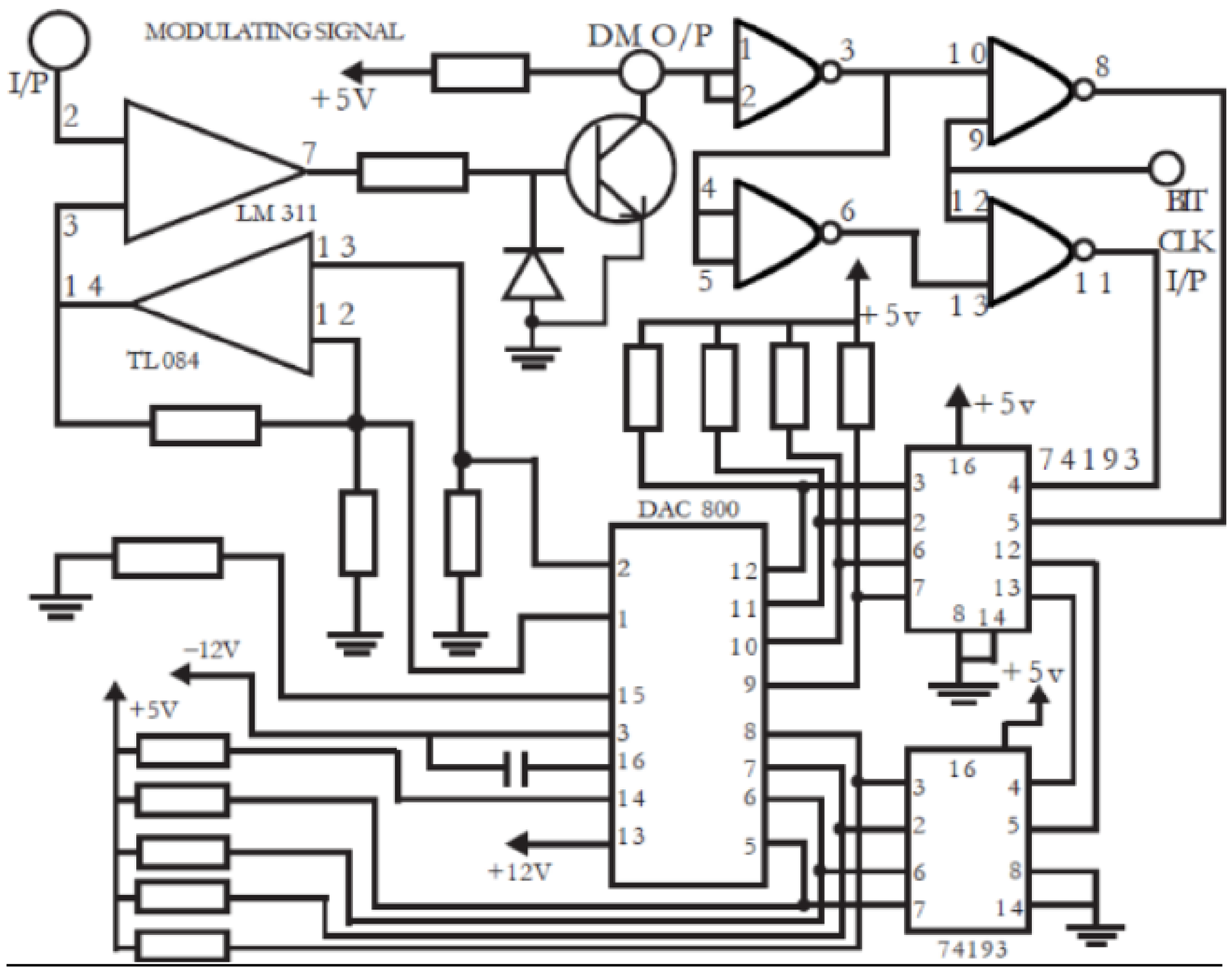
1. Delta Modulation trainer
2. CRO
3. Connecting wires.

Theory:

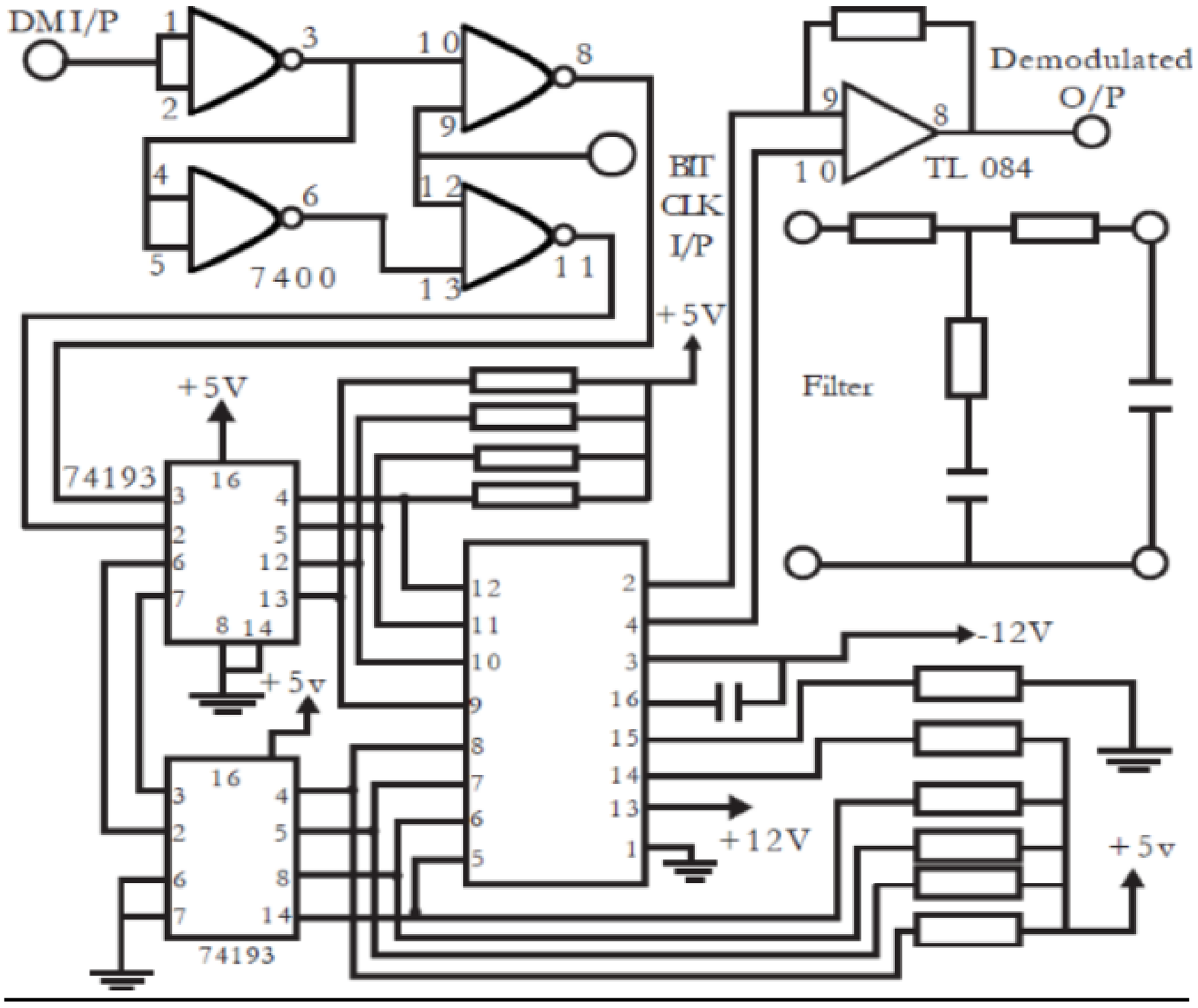
DM uses a single bit PCM code to achieve to achieve digital transmission of analog signal. With conventional PCM each code is binary representation of both sign
and magnitude of a particular sample. With DM, rather than transmitting a coded
representation of a sample a single bit is transmitted, which indicates whether the sample is smaller or larger than the previous sample. The algorithm for a delta modulation system is a simple one. If the current sample is smaller than the previous sample then logic 0 is transmitted or logic 1 is transmitted if the current sample is larger than the previous sample. The input analog is sampled and converted to a PAM signal followed by comparing it with the output of the DAC. The output of the DAC is equal to the regenerated magnitude of the previous sample which was stored in the up/down counter as a binary number. The up/down counter is incremented or decremented whether the previous sample is larger or smaller than the current sample. The up/down counter is clocked at a rate equal to the sample rate. So, the up/down counter is updated after each comparison.

Circuit Diagram:-

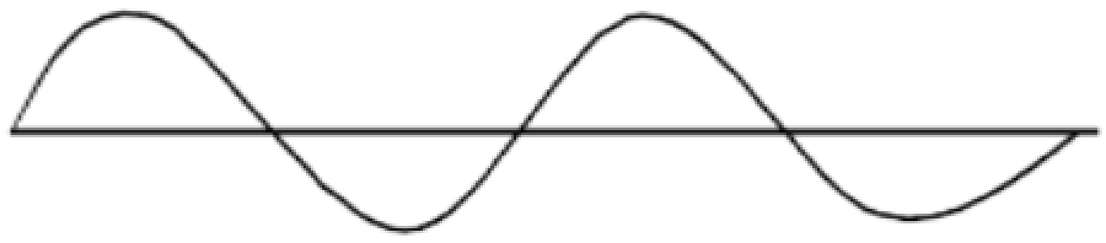
Modulator:-



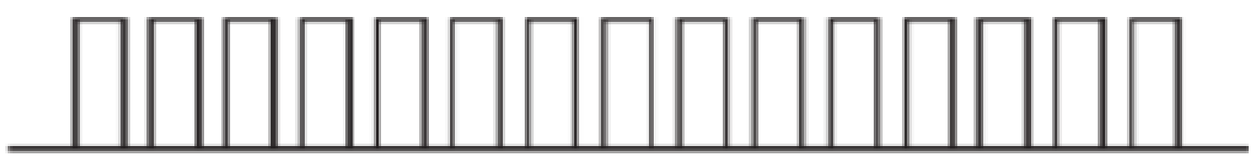
Demodulator:-



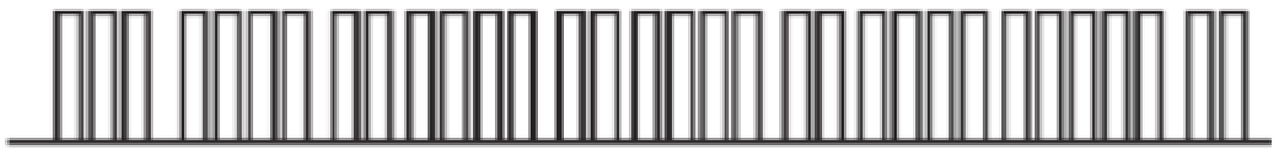
Expected Waveforms:



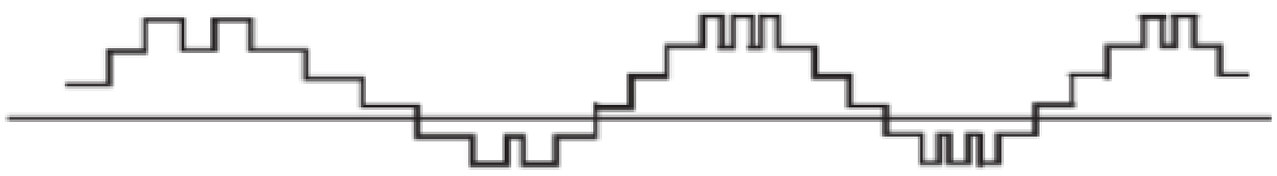
Modulating Signal I/P



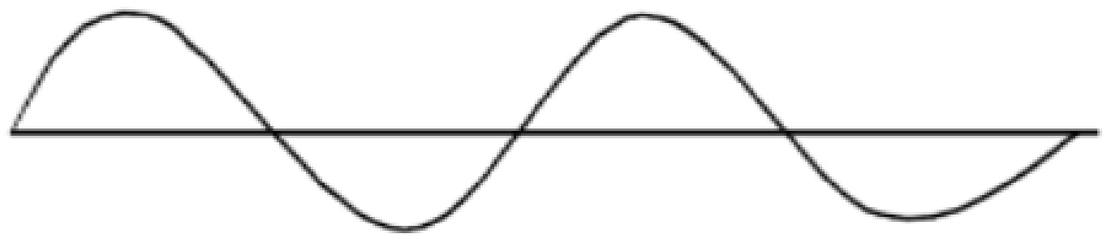
Clock I/P



Delta Modulator O/P



D/A Output



Filtered Output

Result: Performance of the Delta modulation is observed.

EXPERIMENT NO-4

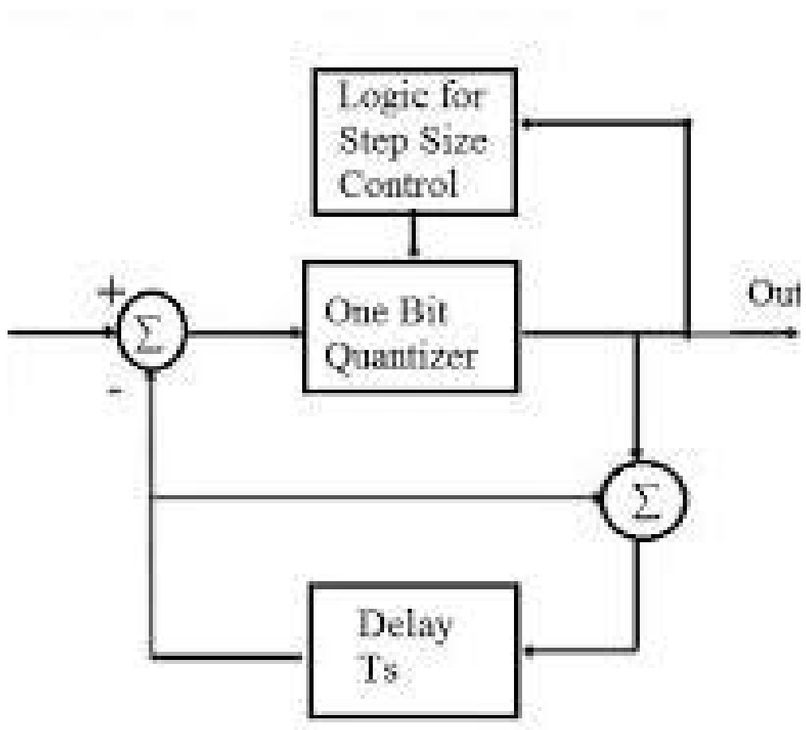
ADAPTIVE DELTA MODULATION & DEMODULATION

Aim: Study and analysis of the Adaptive Delta modulator/demodulator.

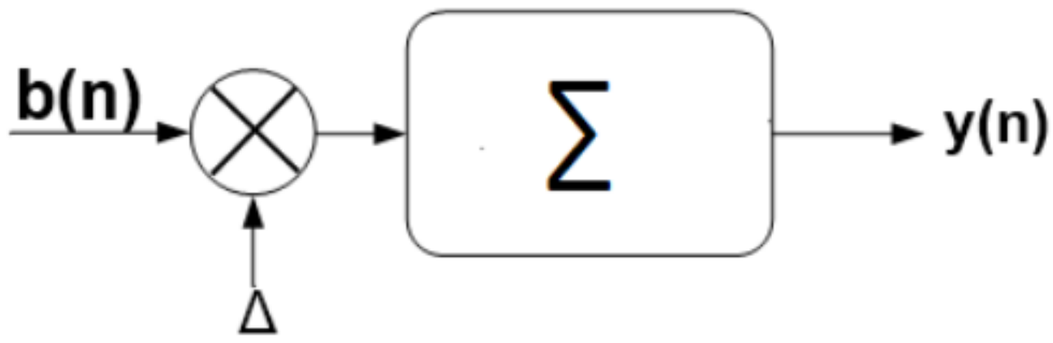
Setup requirement:
TechBook Board 2803
Power Supply
DSO
Test Probe

Theory – Delta modulation is an important modulation technique employed for data communication. Since, slope overload and granular noise are big problem in delta modulator, adaptive delta modulation became more important. In adaptive delta modulator, we optimize the step size in such a way that mean square value of the quantization error of delta modulator can be minimized.
Block Diagram/ Circuit Diagram –

MODULATOR:



DEMODULATOR:



(b) Demodulator

Results - Thus the Adaptive delta modulation and demodulation were performed with lower slope overload and granular noise as compared to delta modulation. Accordingly, graphs are plotted as given in observation table.

Precautions-
1. Switch off the experimental kit during making connections.
2. Use the DSO carefully.

EXPERIMENT NO-5

TIME DIVISION MULTIPLEXING & DEMULTIPLEXING

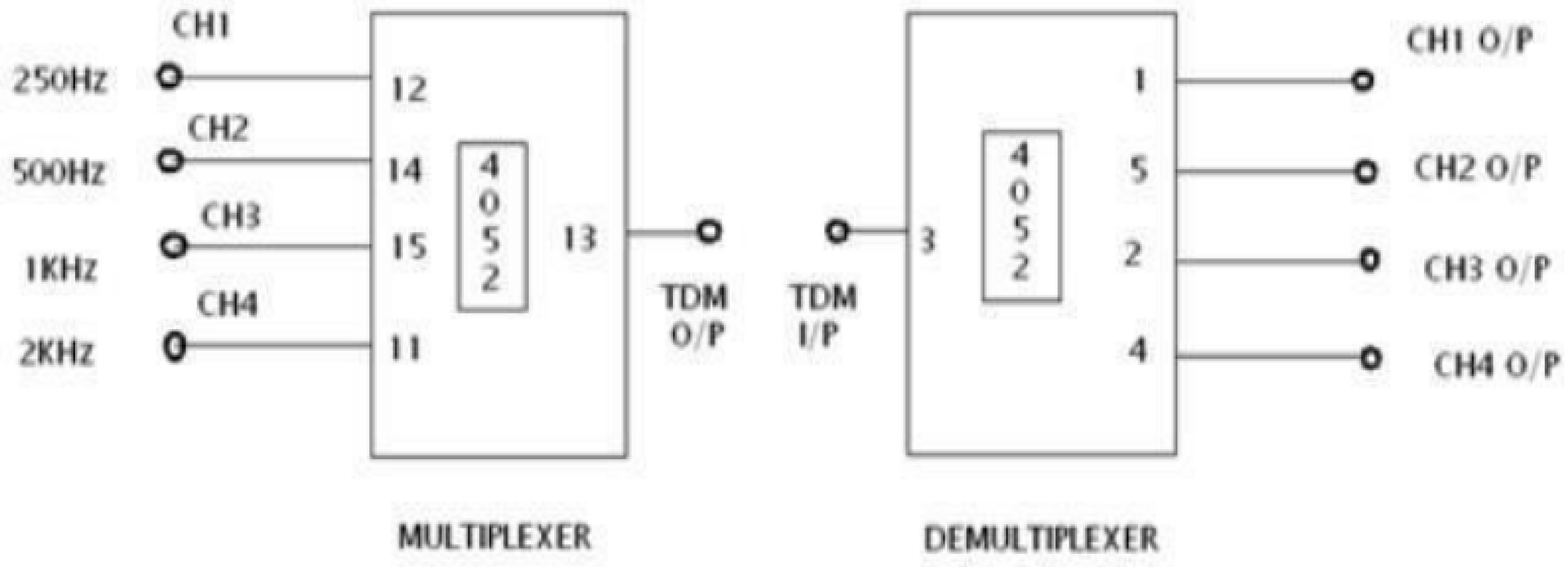
Aim:
Study of Time division Multiplexing and De multiplexing Techniques.

Apparatus:
1. Time division multiplexing & demultiplexing trainer kit.
2. CRO (30 mhz) 3.Patch chords.

Theory:

The TDM is used for transmitting several analog message signals over a Communication channel by dividing the time frame into slots, one slot for each message signal. The four input signals, all band limited by the input filters are sequentially sampled, the output of which is a PAM waveform containing samples of the input signals periodically interlaced in time.

CIRCUIT DIAGRAM:



Procedure:

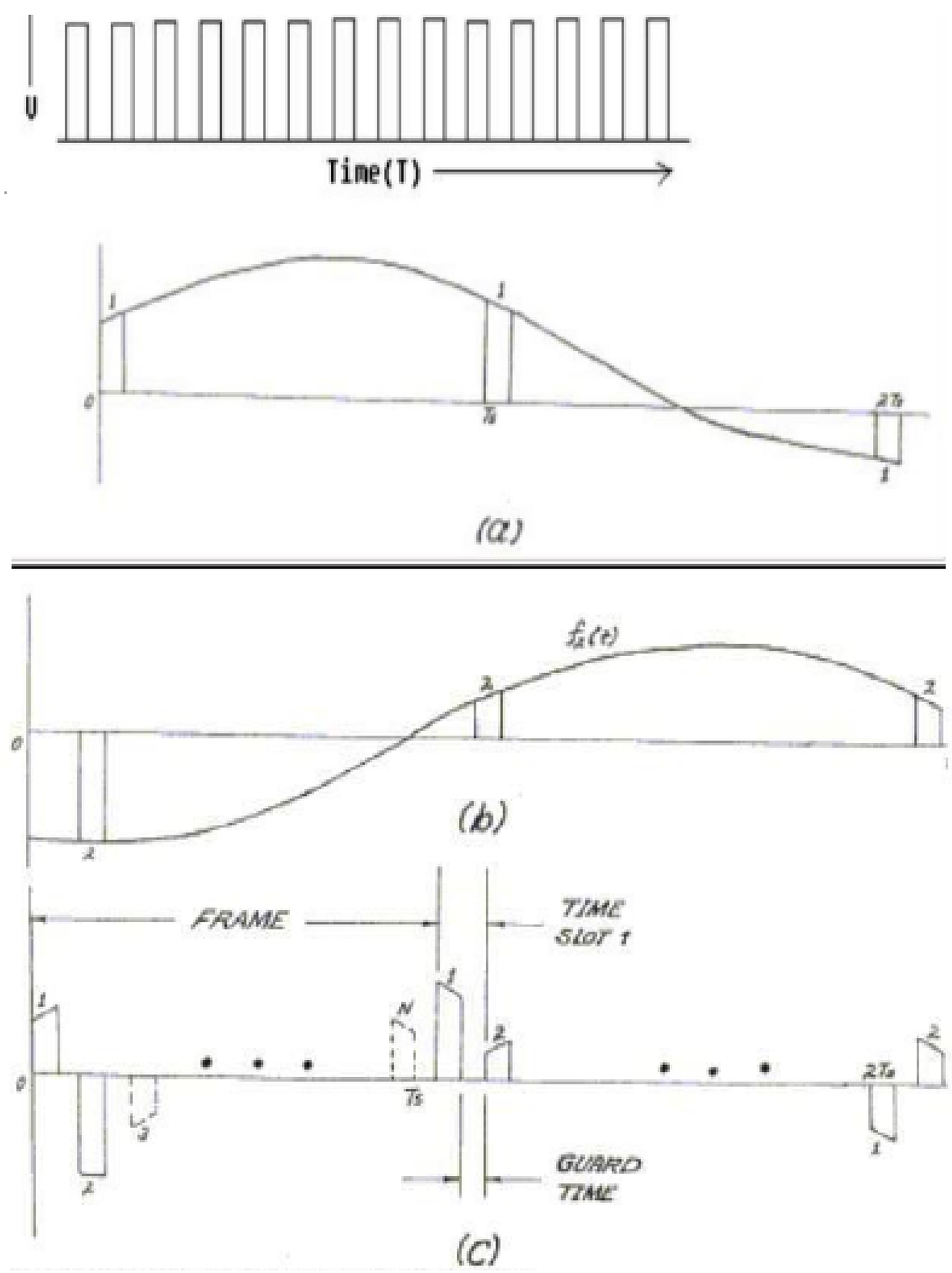
Multiplexing:
1. Connect the circuit as shown in diagram.
2. Switch ON the power supply.
3. Set the amplitude of each modulating signal as 5v peak-peak.
4. Monitor the outputs at test points 5,6,7,8. these are natural sampling PAM outputs. 5. Observe the outputs varying the duty cycle pot(P5). The PAM outputs will varying with 10% to 50% duty cycle.
6. Try varying the amplitude of modulating signal corresponding each channel by using amplitude pots P1,P2,P3,P4. Observe the effect on all outputs.
7. Observe the TDM output at pin no. 13 (at TP9) OF 4052. all the multiplexer channel are observed during the full period of the clock(1/32 KHz).

Demultiplexing & Low Pass Filter:

1. Connect the circuit as shown in diagram 2.

2. Observe the demultiplexed outputs at test points 13,14,15,16 respectively. 3.Observe by varying the duty cycle pot P5 and see the effect on the outputs. 4.Observe the low pass filter outputs for each channel at test points 17,18,19,20 and at sockets channels CH1,CH2,CH3,CH4. These signals are true replica of the inputs. These signals have lower amplitude.

Expected Waveforms:



Result:

TDM wave form is obtained.