4. TIME DIVISION MULTIPLEXING (TDM)

1. Course, Subject & Experiment Details

Academic Year	2018 – 2019	Estimated Time	Experiment No.4 – 02 Hours
Course & Semester	S.E. (COMP) – Sem. III	Subject Name	Basic Electronics Lab
Chapter No. & Unit	05 – Unit 5.2 Mapped with CO-2	Chapter Title	Concept of Sampling
Experiment Type	Hardware (Trainer Kits)	Subject Code	CSL 302

2. Aim & Objective of Experiment

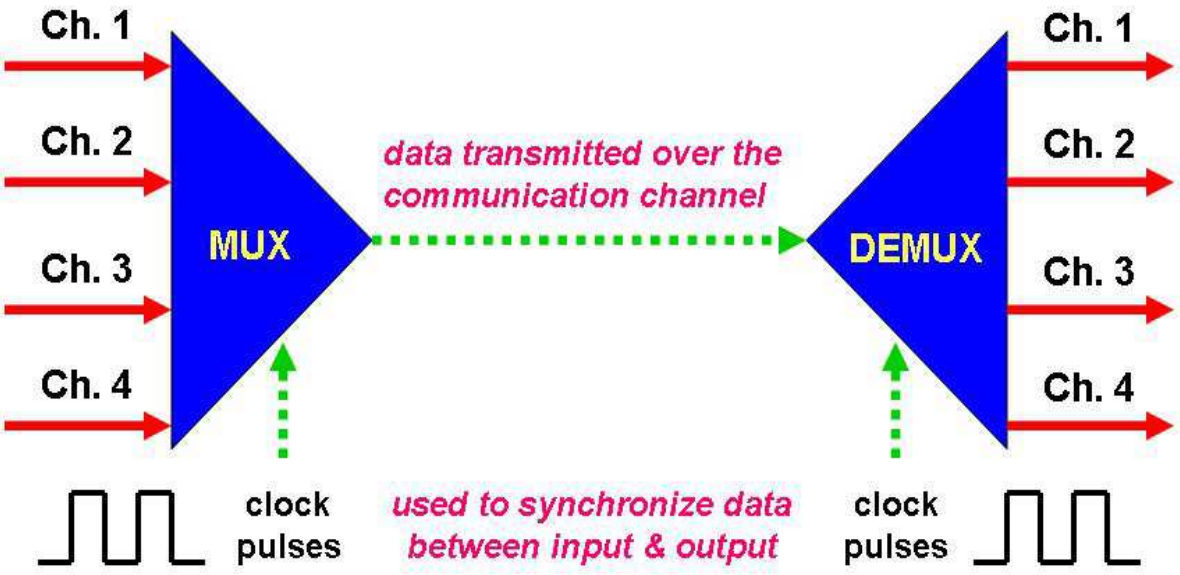
The aim of this experiment is to introduce the concept of multiplexing to students – a process in which many or multiple analog baseband signals, represented by their individual samples, can be simultaneously transmitted over the same communication channel between the transmitter & the receiver. The objective is to demonstrate time division multiplexing (TDM) – where signals are multiplexed in the time domain.

3. Expected Outcome of Experiment

- Understanding time division multiplexing (TDM) technique
- Understanding synchronization between the transmitter & receiver
- Observing the time division multiplexed (TDM) nature of the output waveform
- Observing & understanding reconstruction from the multiplexed waveform

4. Brief Theoretical Description

(a) Introduction to Multiplexing :-

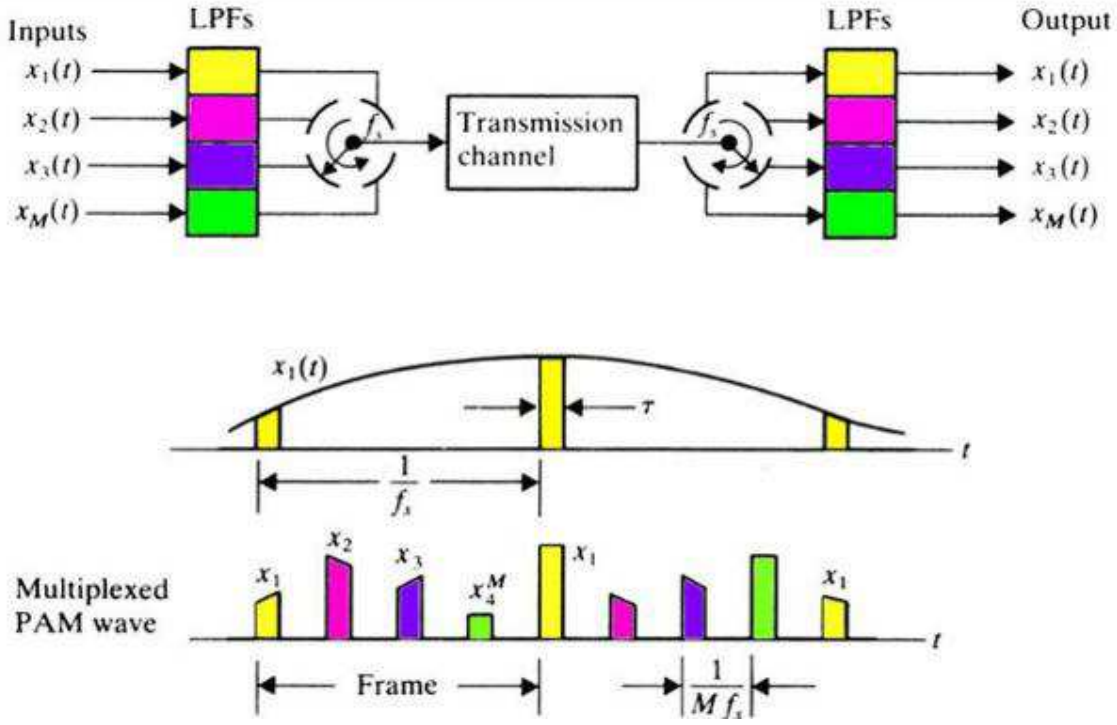


- Multiplexing is process of simultaneously transmitting two or more (multiple) signals over common communication channel or transmission medium
- Due to multiplexing, it is indeed possible to increase total number of channel which for transmitting over a single communication channel, without mixing
- It consists of a multiplexer at the input which accepts multiple different input signals or channels, which it does by sampling each given input signal (channel) at a given point of time
- The output consists of a demultiplexer which is used to sort out the received signals to their appropriate destinations at the receiver, keeping synchronization with the transmitter
- Multiplexing is most commonly used for all practical applications like telemetry, telephony, satellite & mobile communications, optical fiber communications etc.

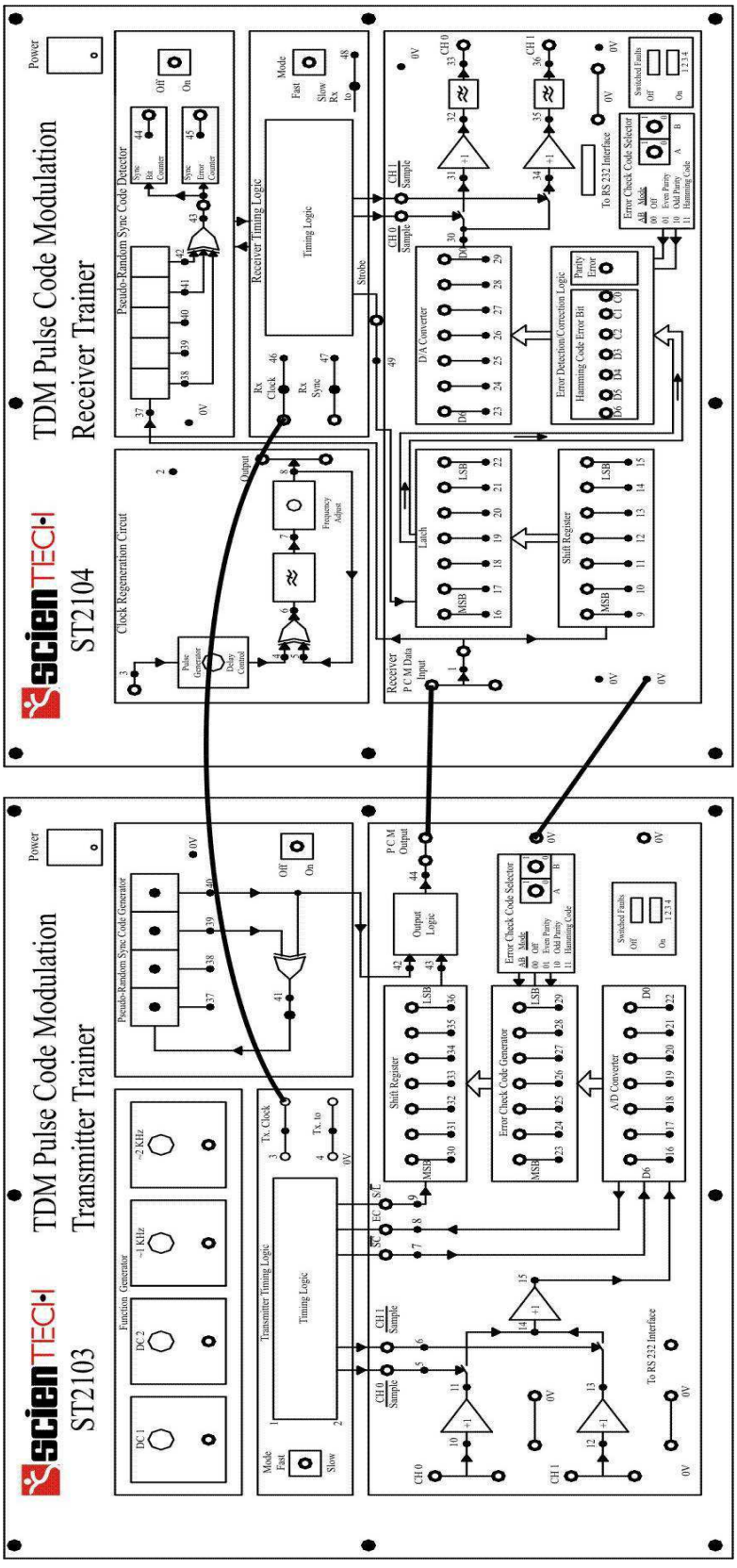
(b) Time Division Multiplexing (TDM) :-

Time division multiplexing is technique of transmitting more than one information on the same channel. As can be noticed from the figure below the samples consists of short pulses followed by another pulse after a long time interval. This no-activity time intervals can be used to include samples from the other channels as well. This means that several information signals can be transmitted over a single channel by sending samples from different information sources at different moments in time. This technique is known as time division multiplexing or TDM. TDM is widely used in digital communication systems to increase the efficiency of the transmitting medium.

TDM can be achieved by electronically switching the samples such that they interleave sequentially at a correct instant in time without mutual interference. The basic 4 – channel TDM is shown below. The switches S_1 & S_2 are rotating in the shown direction in a synchronized manner, where S_1 is sampling channel to the transmission media. The timing of the two switches is very important to ensure that the samples of one channel are received only by corresponding channel at receiver. This synchronization between S_1 & S_2 must be established by some means for reliable communication. One such method is to send synchronization code along itself to the transmitter all the time.



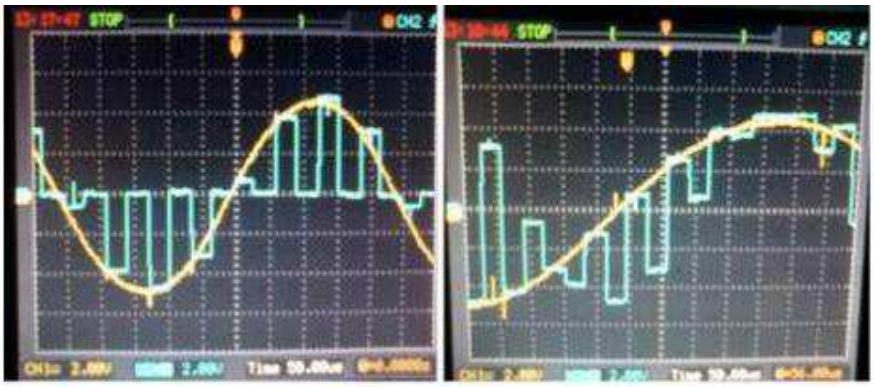
5. Circuit Diagram & Experimental Setup



6. Experimental Procedure

1. Adjust the initial frequency & amplitude of both input modulating signals on the trainer kit.
2. Adjust the amplitude & frequency of the carrier signal (pulses) & apply it to the modulator.
3. Apply them to the input of the multiplexer & observe the output waveforms on the CRO.
4. At the receiver, perform demultiplexing to verify whether the baseband signals have been recovered.

7. Expected Nature of Waveforms



TDM Output Waveform with 1st Modulating Signal

TDM Output Waveform with 2nd Modulating Signal

8. Conclusions & Inferences

Students should explain in brief the concluded outcome from the experiment & its inference, as obtained from observation table & nature of the graph which explains the system behavior as per the conditions

9. Practical & Real Life Applications

- Pulse Code Modulation (PCM) system used in Telephony
- Synchronous Optical Networking Technology (SONET)
- Basic & Primary Rate Interface (BRI & PRI) for Integrated Services Digital Network (ISDN)
- Resource Interchange File Format (RIFF) – WAV for audio standard applications
- Global System for Mobile (GSM) Telephone System Applications

10. Post Lab Questions

1. Explain time division multiplexing (TDM) process with a neat block diagram of modulation & demodulation process, along with its input/output waveforms, advantages & disadvantages.

2. With neat block diagram & proper illustrations, explain the difference between synchronous & asynchronous time division multiplexing (TDM) techniques. Why is synchronization important in TDM ?

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