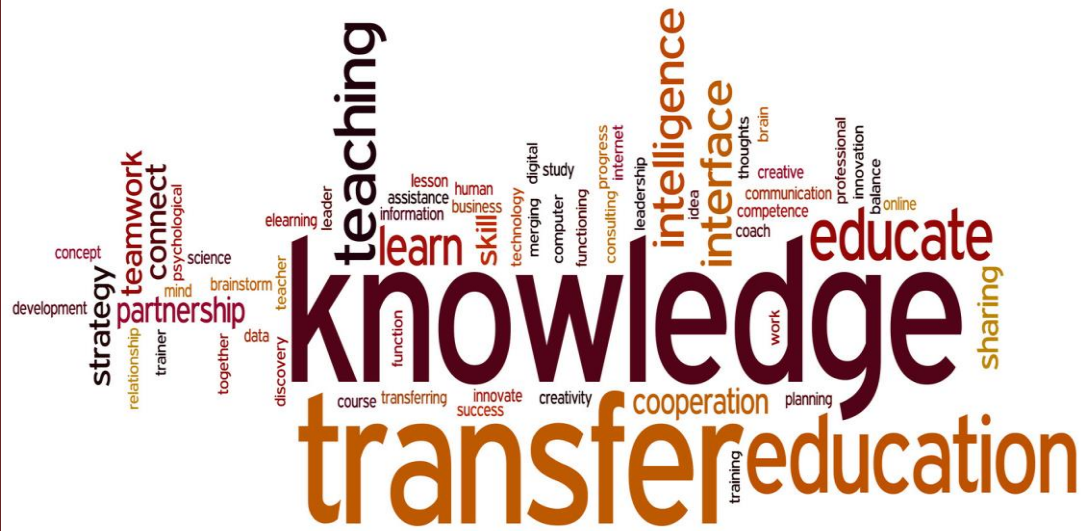


Lab manual – DIGITAL COMMUNICATION LAB (5209)



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Department of Electronics & Communication Engineering
GOVERNMENT POLYTECHNIC COLLEGE, PERUMBAVOOR

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Test 1:		Test 2:	
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Exp No. Date: - - **VISION AND MISSION****Government Polytechnic College, Perumbavoor- Vision and Mission****Vision**

Excel as a centre of skill education moulding professionals who sincerely strive for the betterment of society.

Mission

- To impart state of the art knowledge and skill to the graduate and moulding them to be competent, committed and responsible for the well being of society.
- To apply technology in the traditional skills, thereby enhancing the living standard of the community

Department of Electronics & Communication Engineering**Vision**

Excel as a centre of skill education in Electronics and Communication Engineering, moulding professionals who sincerely strive for the betterment of themselves and society.

Mission

- To impart state of the art knowledge, skill and attitude to the students and contributing to their sustainable development.
- To merge technologies in the field of Electronics and Communication Engineering with occupational skills, thereby improving quality of living.

Exp No.

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PEO, PO and PSOs of the Program**Program Educational Objectives (PEOs)**

PEO1: Secure successful careers in manufacturing, testing, maintenance, development and marketing in Electronics and Communication Engineering.

PEO2: Acquire knowledge and competency in the domain to develop innovative, cost effective and socially acceptable solutions to engineering problems in a multi-disciplinary work environment.

PEO3: Develop strong fundamental knowledge that prepares them for professional careers/higher studies with attitude for lifelong learning.

PEO4: Instill the attitude to be sensitive to ethical, societal and environmental issues while pursuing their professional duties.

PEO5: Possess leadership qualities and be effective communicator to work efficiently with diverse teams, promote and practice appropriate ethical practices.

Program Outcomes (POs)

PO1: Basic Knowledge: Apply knowledge of basic mathematics, science and engineering to the solution of engineering problems.

PO2: Discipline knowledge: Apply knowledge in Electronics and Communication Engineering to solve applied engineering problems.

PO3: Experiments and practice: Able to plan and perform experiments and practices and to solve engineering problems.

PO4: Engineering Tools: Apply appropriate technologies and tools with proper understanding of their limitations.

PO5: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO6: Environment and sustainability: Understand the impact of the engineering solutions in societal and environmental contexts and demonstrate the knowledge and need for sustainable development.

PO7: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and

norms of the engineering practice.

PO8: Individual and team work: Function effectively as an individual and as a member or leader in diverse multidisciplinary teams.

PO9: Communication: Able to communicate effectively.

PO10: Lifelong learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the context of technological changes.

Program Specific Outcome (PSO):

PSO1: Specialization knowledge: Apply concepts and knowledge in the field of semiconductor devices, communication and networking technologies, embedded systems.

PSO2: Professional growth: Generate ideas from the knowledge of engineering specialization leading to professional growth.

PSO3: Entrepreneurship: Apply knowledge and understanding of engineering principles to initiate entrepreneurship ventures.

Exp No.

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Date:

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SAFETY PROCEDURES

Problem Statement:

The safety instructions are presented to the attention of the students as a mean of preventing accidents while performing experiments and activities in the communication lab of the department. The purpose is to draw attention to the risks involved in lab activities to prevent human suffering and damage to equipment.

Safety in the laboratory:

Working in the lab is not allowed without following electricity precautions displayed.

No individual work is allowed in the lab.

Laboratory in charge is responsible for the arrangements of your lab activities; Listen carefully to his/her instructions and follow them.

To do and not to do:

Inform the lab in charge about dangerous conditions and faults in the lab or nearby environment.

Do not do any action that may harm people or equipments in the lab.

Do not misuse any of the tools or instruments belong to the lab.

Strict discipline should be maintained in the laboratory.

Turn off cell phones before entering the lab.

At the end and beginning of laboratory, follow 5S procedures and leave the work table clean and tidy.

Electrical Safety:

Consult Electrical Engineering section available in the campus for electrical safety queries.

The lab equipment is powered from electrical sockets installed on the tables. Do not use equipment that is powered from a damaged socket.

Do not use equipment that is powered from flexible cable with damaged insulation or if it's plug is not assembled properly.

Do not repair or disassemble electrical equipment including replacement of fuses installed in the equipment.

Do not open the main fuse box, unless it is an emergency and you need to switch off main circuit breaker.

Emergency Switches:

The laboratory has circuit breakers, which is located in the main panel. Identify the place. In an emergency condition, switch off circuit breakers immediately.

Result:

Familiarization of safety precautions performed.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

2

Date:

D	D	-	M	M	-	Y	Y
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HANDLING ELECTROSTATIC DISCHARGE (ESD)

Problem Statement:

Familiarize ESD handling procedures in the laboratory

Theory:

In handling electronic devices, datasheets cautions about ESD (Electrostatic Discharge) precautions. These devices are prone to damage because of electrostatic charges made by human body. These charges may be up to 4000 volts and cause damage without being noticed. It is recommended to follow ESD precautions on handling of these devices.

Points for the elimination of ESD damage to electronic components

1. Make sure you have a reliable ground point available near the table.
2. Do not wear clothing which generates static electric charges every time you move.
3. Do not handle static generating objects while working on electronics.
4. Store all chips and other components in appropriate anti-static containers.
5. Keep all ESD sensitive components and spares in anti-static envelopes for storage.
6. Be sure to turn off the power and remove the power plug from all equipment before working repairing or assembling.
7. Do not plug in or remove equipments while the power is on.

Result:

Familiarization of ESD protection procedures performed.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

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Date:

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FAMILIARIZATION OF TOOLS AND PROCEDURES

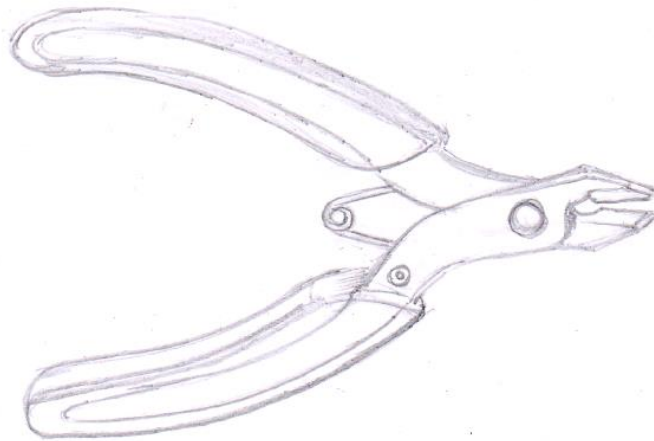
Problem Statement:

Familiarize proper usage of tools used for handling components.

Theory:

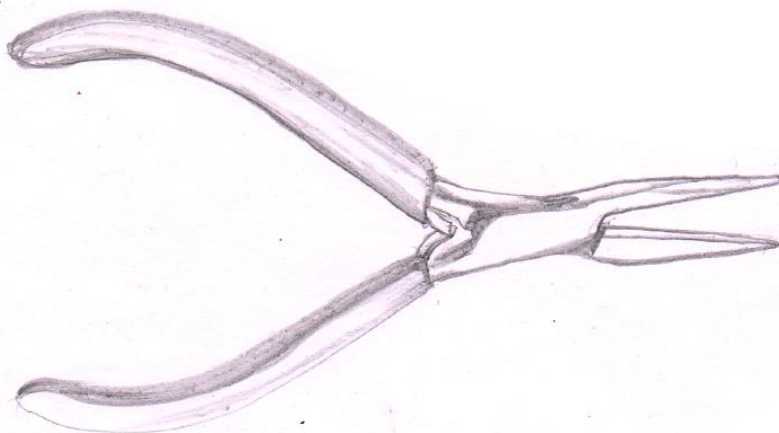
Nipper

These electronic nippers are for cutting wires and component leads. They have a cushioned handle which makes them much more comfortable to use.



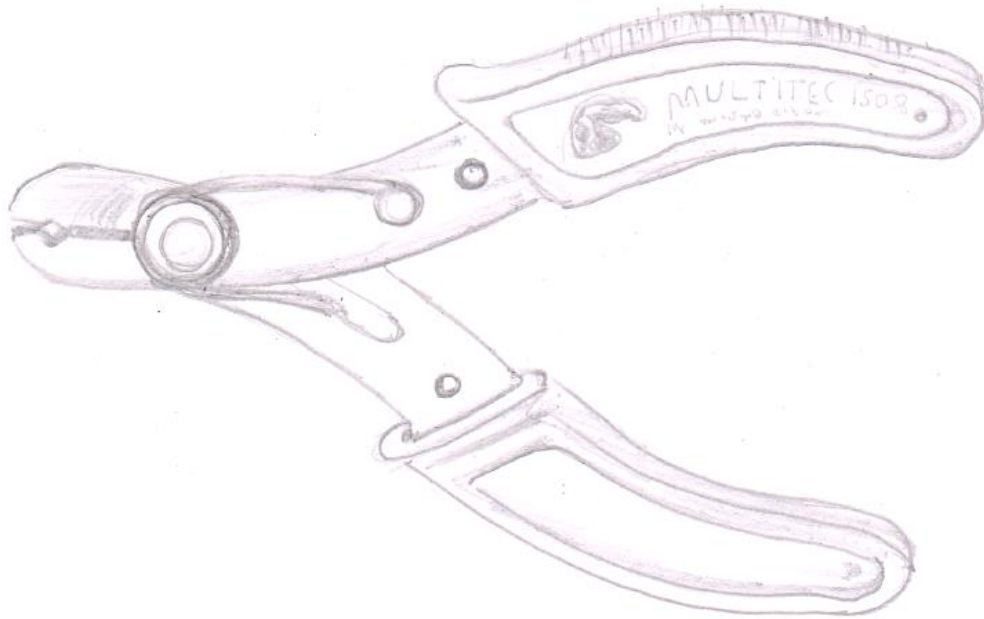
Long nose pliers

Needle-nose pliers are both cutting and holding pliers used to bend, re-position and snip wire. Because of their long shape they are useful for reaching into small areas where cables or other materials have become stuck or unreachable with fingers or other means.



Wire stripper

A wire stripper is a small, hand-held device used to strip the electrical insulation from electric wires.



Result:

Familiarized proper usage of tools used for handling components.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

4

Date:

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PULSE AMPLITUDE MODULATOR AND DEMODULATOR

Problem Statement:

Construct Pulse Amplitude Modulator and Demodulator circuits and observe the waveforms.

Components & Equipment Required:

Sl. No.	Item & Specification	Quantity
1	BJT – BC107	1
2	Resistor- 10K Ω 1.5K Ω	2 1
3	Capacitor- 1 μ F	1
4	Signal Generator	2
5	DSO	1
6	Bread Board	1
7	Wires and probes	

Theory:

Pulse Amplitude Modulation (PAM) is the simplest pulse modulation scheme. In this, the amplitude of a carrier pulse train is varied in accordance with the instantaneous level of the modulating signal. The simplest form of the PAM modulator is an analog switch that is turned on and off using the carrier pulse. In modulator circuit, BJT is used as a switch and carrier pulses are applied to the base of the transistor that switches it ON and OFF. The demodulation can be done by simply passing PAM signal through a low pass filter having a cut-off frequency equal to the highest frequency in the modulating signal..

Procedure:

- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the modulator circuit as per the circuit diagram. Switch on the power supplies.
- Input 5Vpp, 100Hz modulating signal and 5V, 1 KHz square wave carrier signal.
- Observe the PAM output signal at output on one channel of the DSO.
- Set up the demodulator circuit as shown in figure. Feed the PAM signal as the input and observe the demodulated output on the other channel of the DSO. Plot the waveforms.

Circuit Diagram:

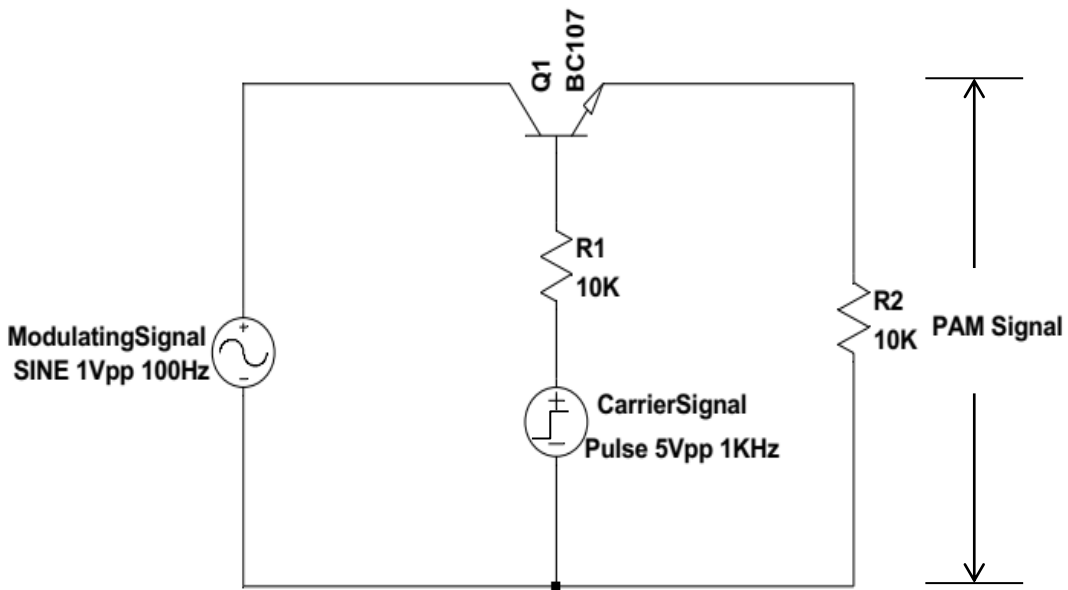


Fig (a) Modulator Circuit

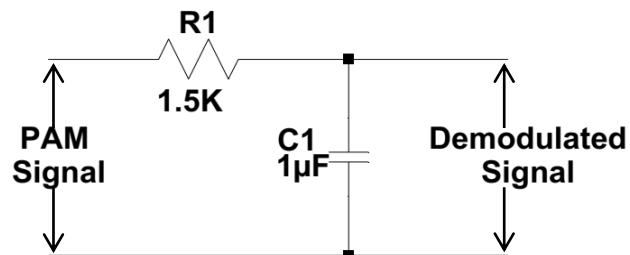
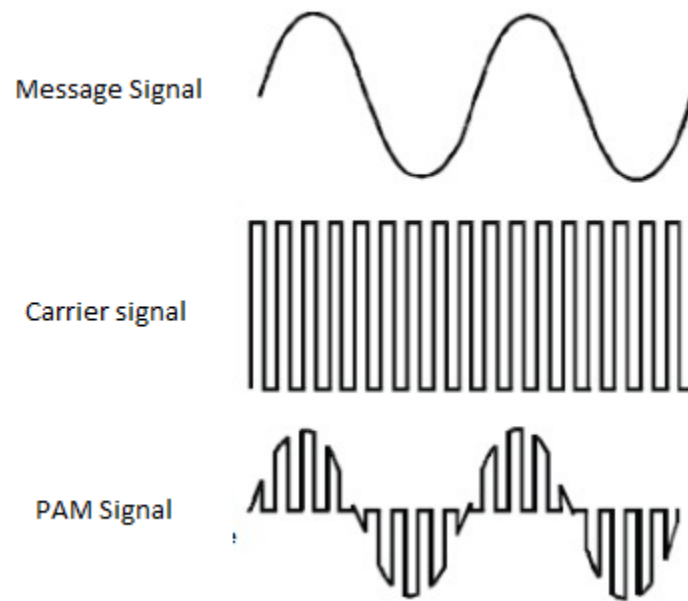


Fig (b) Demodulator Circuit

Waveforms:

**Result:**

The PAM modulator and demodulator circuits were set up and the waveforms were plotted.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

5

Date:

D	D	-	M	M	-	Y	Y
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PULSE WIDTH MODULATOR

Problem Statement:

Construct Pulse Width Modulator circuits and observe the PWM waveforms.

Components & Equipment Required:

<u>Sl. No.</u>	<u>Item & Specification</u>	<u>Quantity</u>
1	IC 555	1
2	Resistor- 1.2K, 4.7K, 10K	1
3	Capacitor-0 .001 μ F, 0.1 μ F, 10 μ F	1
4	Diode 1N 4001	1
5	Signal Generator	2
6	DSO	1
7	Bread Board	1
8	Power Supply 10V	1
9	Wires and probes	

Theory:

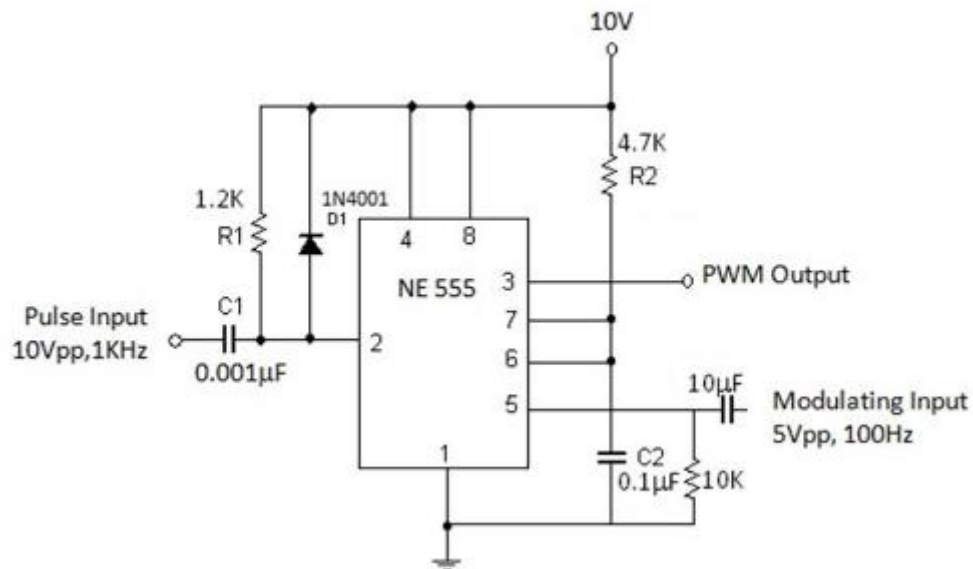
Pulse Width Modulation (PWM) is a form of pulse modulation where the width of the pulses in a carrier pulse train is made proportional to the instantaneous amplitude of the modulating signal. A pulse width modulator circuit made up of 555 Timer is shown in figure. Here the 555 timer is working in monostable mode. The trailing edge of carrier pulse train at pin 2 sets the output. The modulating signal is applied to the control pin of the 555 which varies the threshold voltage. This in turn varies the charging time of capacitor C2 and makes the trailing edge of the output pulse proportional to the modulating signal. Thus the leading edge of the output pulse is decided by the carrier pulse which occurs periodically and the trailing edge is proportional to the amplitude of the modulating signal. The resulting output will be pulse width modulated.

Procedure:

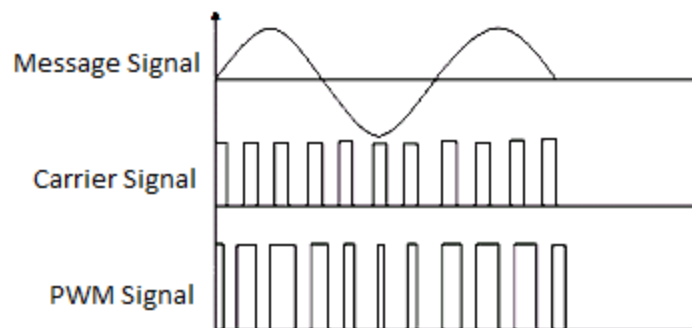
- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the modulator circuit as per the circuit diagram. Switch on the power supplies.
- Input 10Vpp, 1 KHz square wave signal at the trigger input and 5Vpp, 100Hz sine wave at the control input.

- Observe the input modulating signal, carrier pulse train and the PWM output signal on DSO. Vary the modulating signal amplitude to get the optimal output. Plot the waveforms.

Circuit Diagram:



Waveforms:



Result:

Pulse Width Modulator circuit was set up and the waveforms were observed and plotted.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

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Date:

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PULSE POSITION MODULATOR

Problem Statement:

Construct pulse position (PPM) modulator and observe the waveforms.

Components & Equipment Required:

<u>Sl. No.</u>	<u>Item & Specification</u>	<u>Quantity</u>
1	IC 555	2
2	Resistor- 1.2K, 4.7K, 10K	2
3	Capacitor- 0.001 μ F, 0.1 μ F 10 μ F, 0.01 μ F	2 1
4	Diode 1N 4001	2
5	Signal Generator	2
6	DSO	1
7	Bread Board	1
8	Power Supply 10V	1
9	Wires and probes	

Theory:

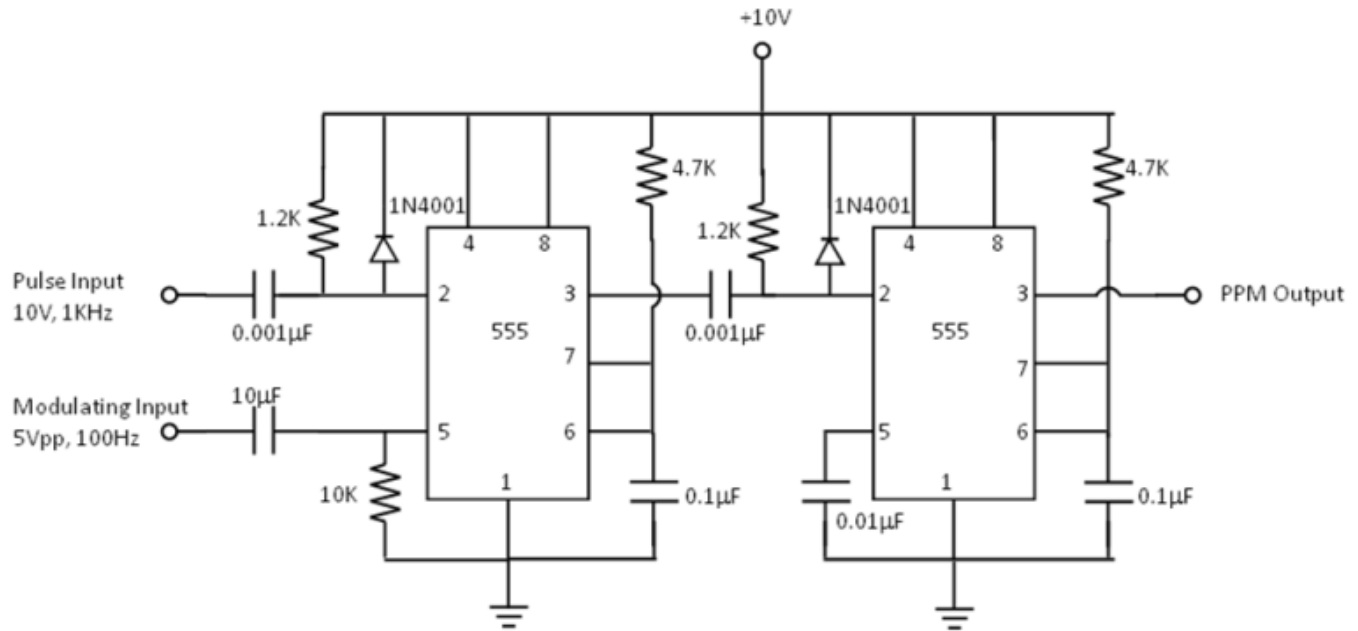
Pulse Position Modulation (PPM) is one of the pulse modulation schemes where the relative position of the pulses in a carrier pulse train is made proportional to the instantaneous value of the modulating signal. A pulse position modulator made up of IC 555 is shown in figure. Both the 555s are working in monostable mode. The first monostable generates a PWM signal and this PWM output is used as the trigger input of the second monostable. Since the monostable triggers at the trailing edge of the PWM signal, the position of the resulting changes with respect to the PWM signal pulse width and as a result position of pulse proportional to the instantaneous value of the modulating signal. The resulting output is a PPM signal.

Procedure:

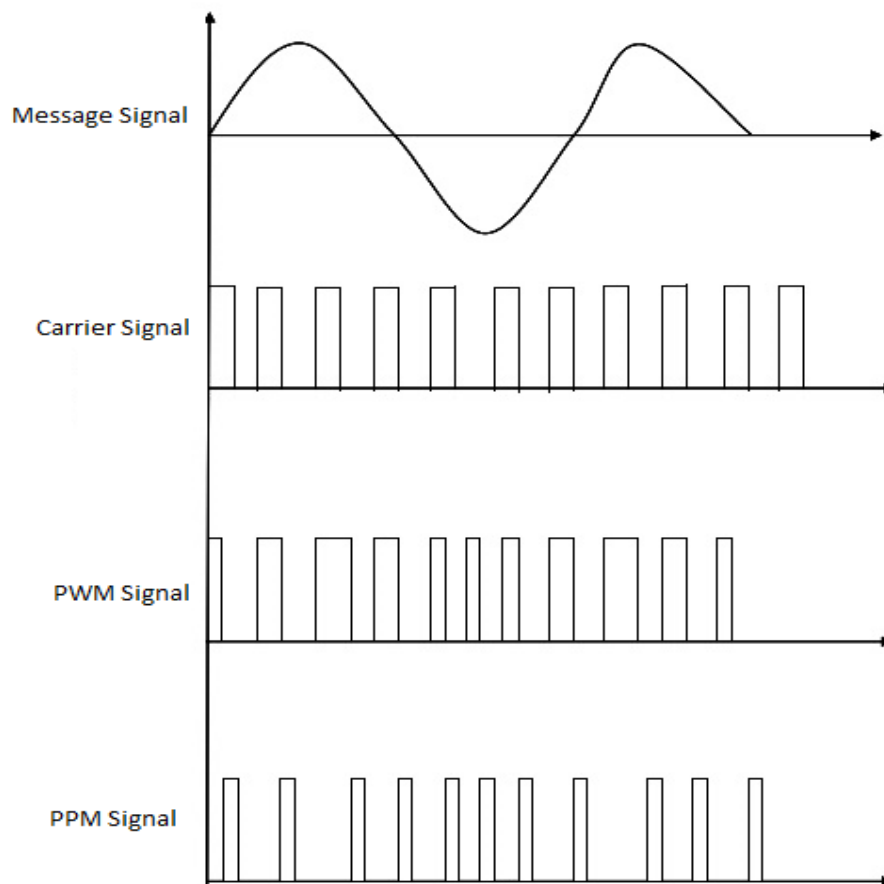
- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the modulator circuit as per the circuit diagram. Switch on the power supplies
- Feed the 10Vpp, 1KHz, 0.2 duty cycle carrier pulse train and the 5Vpp, 100Hz modulating signal (Sine wave) at the trigger and control inputs of the first 555 respectively.
- Make sure that the PWM signal is available at pin 3 of the first 555. Vary the amplitude of the modulating signal to get a proper PWM output if needed.

- Observe the waveforms of the input pulse train, modulating input, PWM output and PPM output on the DSO. Plot the waveforms.

Circuit Diagram:



Waveforms:



Result:

The PPM modulator circuit was set up and the waveforms were observed and plotted.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

7

Date:

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SAMPLING AND RECONSTRUCTION OF SINE WAVE

Problem Statement:

To set up sampling and reconstruction circuits to study the sampling theorem and to plot waveforms for different sampling rates.

Components & Equipment Required:

Sl. No.	Item & Specification	Quantity
1	BJT – BC107	1
2	Resistor- 10K Ω	2
	1.5K Ω	1
3	Capacitor- 1 μ F	1
4	Signal Generator	2
5	DSO	1
6	Bread Board	1
7	Wires and probes	

Theory:

As a first step to convert analog signals into digital form, the samples of the analog signals are taken at regular intervals. The levels of these samples are then encoded and send to the receiver. At the receiver these samples are recovered and from that the original signal is reconstructed. Sampling theorem states that the original signal can be faithfully reconstructed only if the sampling frequency is at least double that of the highest frequency component in the sampled signal.

A sampling and reconstruction circuit is shown in figure. A BJT is used as a switch to take samples of the sine wave input. Sampling pulses are applied to the base of the transistor that switches it ON and OFF The input signal is sent to the output only when the transistor is ON. Thus the output of the BJT is a sampled form of the input signal. The reconstruction circuit is a low pass filter having a cut off frequency equal to the frequency of the analog input signal.

Procedure:

- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the circuit as per the circuit diagram. Switch on the power supplies.

- Feed 5Vpp, 100Hz sine wave as input and 5V, 1 KHz square wave as sampling pulse.
- Observe sampled output and reconstructed signals for the following sampling frequencies; a) 200Hz b) 500Hz c) 1KHz and d) 2KHz.
- Plot the waveforms.
-

Circuit Diagram:

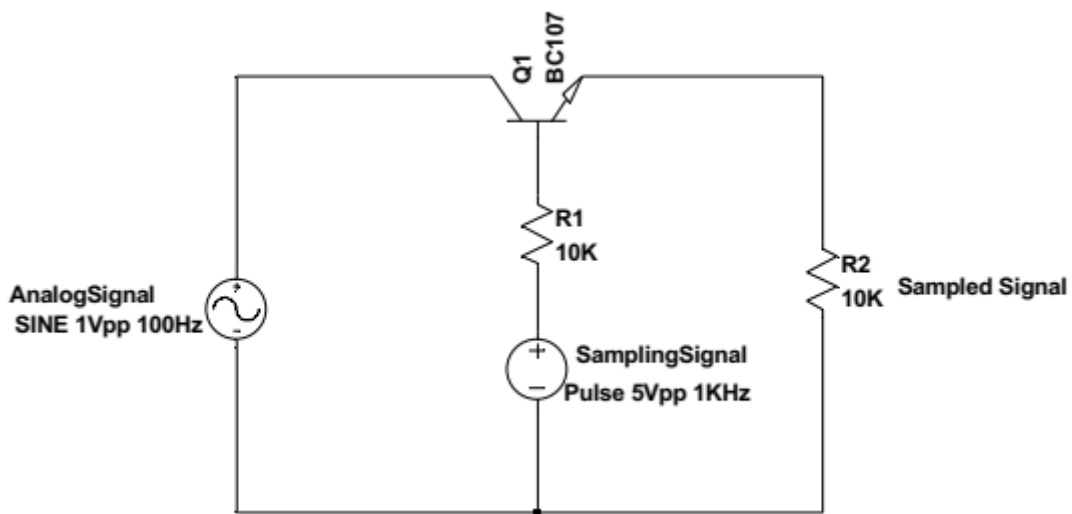


Fig (a) Sampling Circuit

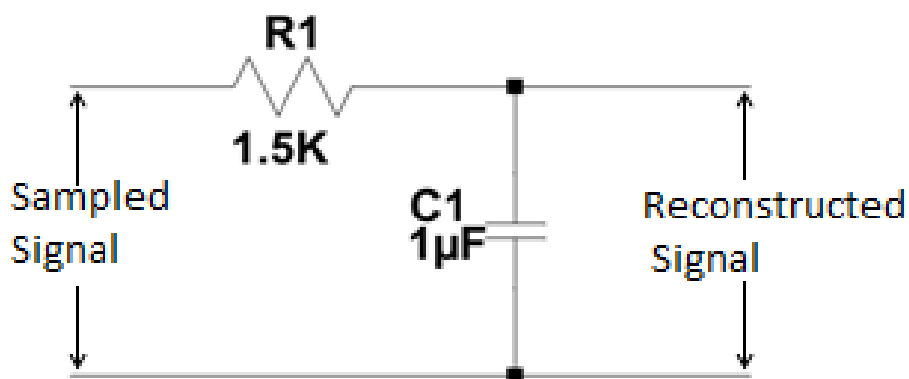
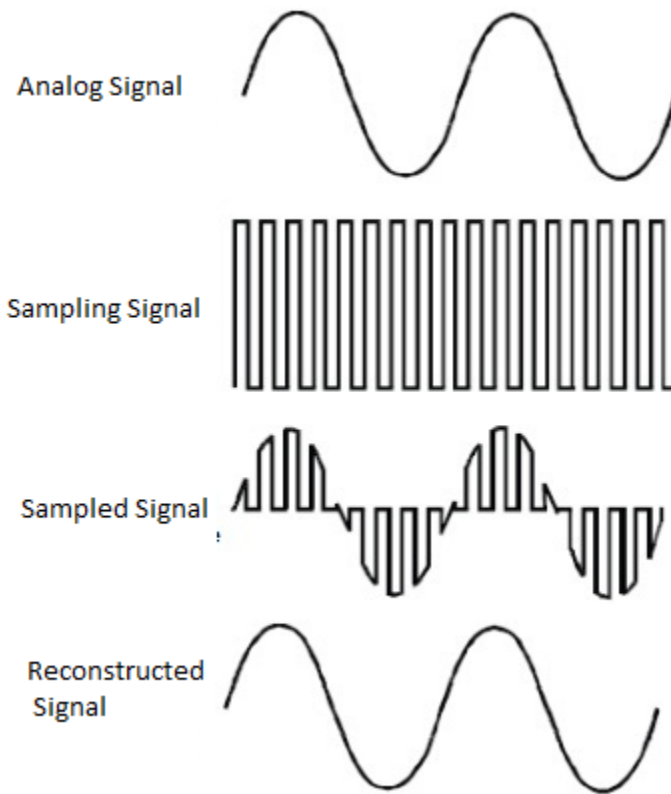


Fig (b) Reconstruction Circuit

Waveforms:**Result:**

Analog Input is sampled at different sampling rates and then reconstructed. Observed the waveforms and plotted.

Inference:

- 1) To reconstruct the original signal, the sampling frequency should at least be double that of the input frequency.
- 2) Reconstructed signal quality improves with increase in sampling frequency.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No. Date:

ASK MODULATOR

Problem Statement:

Construct ASK modulator circuit and observe the waveforms.

Components & Equipment Required:

<u>Sl. No.</u>	<u>Item & Specification</u>	<u>Quantity</u>
1	Transistor- BC 107	1
2	Resistor- 4.7K, 10K,	1
3	Signal Generator	2
4	DSO	1
5	Bread Board	1
6	Power Supply - $\pm 15V$, 5V	1
7	Wires and probes	

Theory:

Amplitude Shift Keying (ASK) is a digital modulation scheme where the binary data is transmitted using a carrier signal with two different amplitude levels. In its simplest form, a carrier is sent during one input and no carrier is sent during the other. A simple ASK modulator circuit is shown in figure. The transistor works as a switch closes when the input (base) voltage is +5V (logic '1') and shorts the output to ground. When the input voltage is -5V (logic '0'), the switch opens and the carrier signal is directly connected to the output.

Procedure:

- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the modulator circuit as per the circuit diagram. Switch on the power supplies
- Feed the 2Vpp, 5 KHz sinusoidal signal as carrier and the 10Vpp, 500Hz square wave signal as data input.
- Observe both the message input and ASK output simultaneously on DSO and plot.

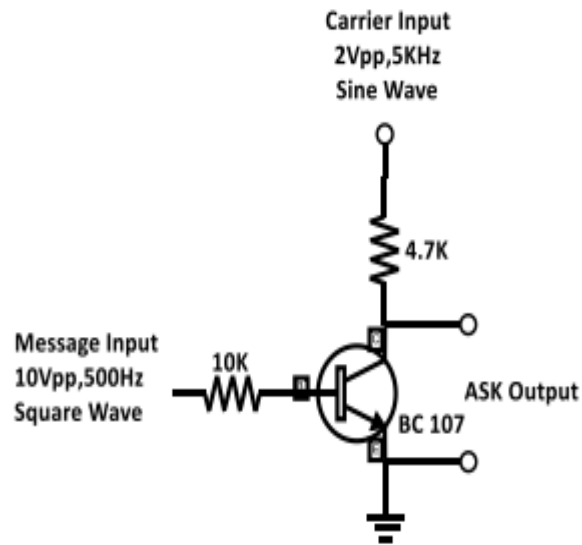
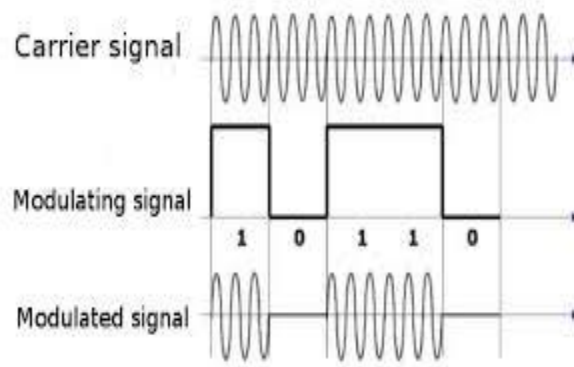
Circuit Diagram:

Fig. ASK Modulator

Waveforms:**Result:**

The ASK modulator circuit are set up and the waveforms were observed and plotted.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

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Date:

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ASK DEMODULATOR

Problem Statement:

Construct ASK demodulator circuit and observe the waveforms.

Components & Equipment Required:

<u>Sl. No.</u>	<u>Item & Specification</u>	<u>Quantity</u>
1	Resistor- 2.2K, 1K,10K pot	1
2	Capacitor- 0.01 μ F	1
3	Diode 1N 4001	1
4	Zener Diode- 5Z1	2
5	IC 741	1
6	Signal Generator	2
7	DSO	1
8	Bread Board	1
9	Power Supply - \pm 15V, 5V	1
10	Wires and probes	

Theory:

Amplitude Shift Keying (ASK) is a digital modulation scheme where the binary data is transmitted using a carrier signal with two different amplitude levels. In its simplest form, a carrier is sent during one input and no carrier is sent during the other.

The demodulator circuit consists of an envelope detector and a comparator. The diode D selects the positive half cycle of the ASK input. The envelop detector formed by 2.2K resistor and 0.01 μ F capacitor detects the data out of the ASK input. The Op Amp comparator and the zener diode amplitude limiter convert this detected signal to its original logic levels. The 10K potentiometer may be varied to set suitable reference voltage for the comparator.

Procedure:

- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Apply the ASK output of the modulator to the demodulator input.
- Observe both the ASK input and the demodulated output simultaneously on DSO. Adjust the reference voltage of the comparator if needed. Plot the waveforms.

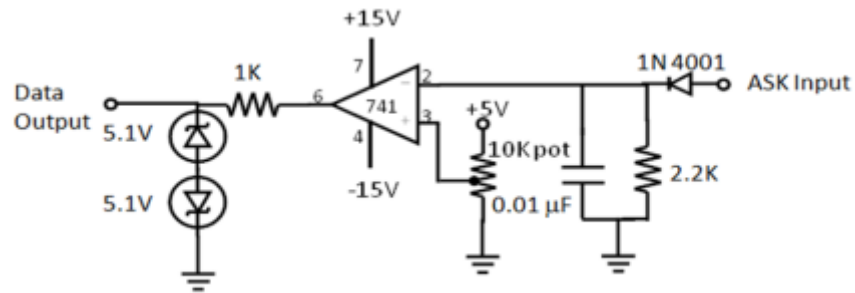
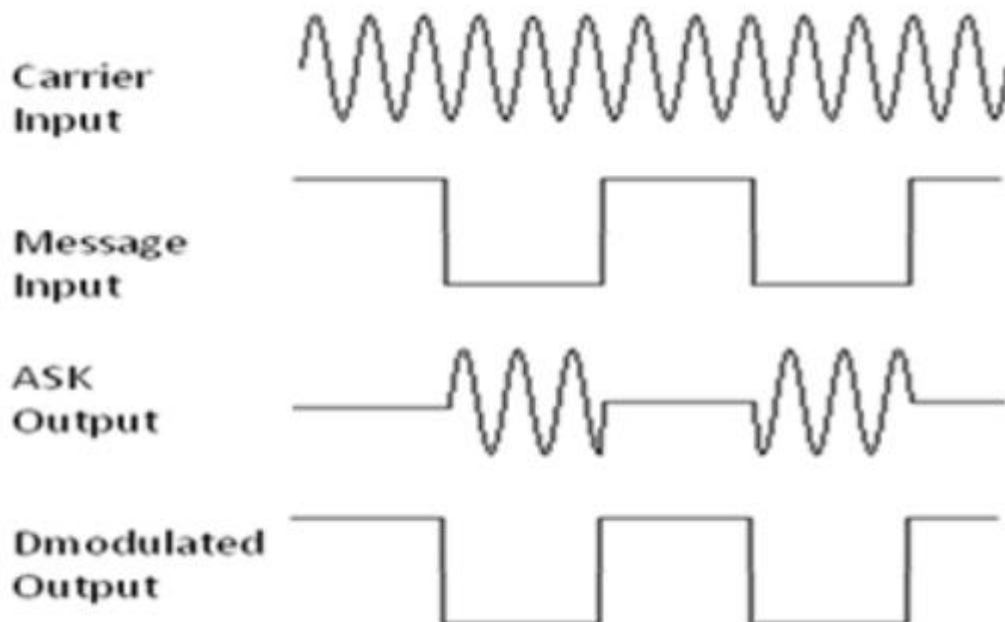
Circuit Diagram:

Fig. ASK Demodulator

Waveforms:**Result:**

The ASK demodulator circuit are set up and the waveforms were observed and plotted.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

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Date:

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FSK MODULATOR

Problem Statement:

Construct FSK modulator circuit and observe the waveforms.

Components & Equipment Required:

Sl. No.	Item & Specification	Quantity
1	Transistor- SL100, SK100	1
2	Resistor- 1K 10K	2 4
3	IC 741	1
4	Signal Generator	3
5	DSO	1
6	Bread Board	1
7	Power Supply - $\pm 15V$	1
8	Wires and probes	

Theory:

Frequency Shift Keying (FSK) is a digital modulation scheme where the digital data is transmitted using a high frequency carrier signal. For logic '0' and '1' the carrier signal switches between two preset frequencies, hence the name FSK.

A frequency shift keying modulator circuit made up of 555 timer is shown in figure. The 555 IC works in monostable mode. For logic '1' transistor BC 177 is OFF and the monostable works in normal mode and capacitor C1 charges through RA and RB and the output frequency is at the first preset level. For logic '0' the transistor is ON and the resistor RC comes in parallel with RA and reduces its effective resistance. The charging rate of the capacitor decreases and a higher frequency signal is obtained at the output. This is the second preset frequency level. Thus the output signal switches between the two preset frequencies for logic '0' and '1'. The resulting signal is FSK modulated.

Procedure:

- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the modulator circuit as per the circuit diagram. Switch on the power supplies
- Feed the 2Vpp, 1KHz & 2Vpp, 2KHz sinusoidal signals as carriers and the 10Vpp, 200Hz square wave signal as data input.

- Observe both the message input and FSK output simultaneously on DSO. Plot the waveforms

Circuit Diagram:

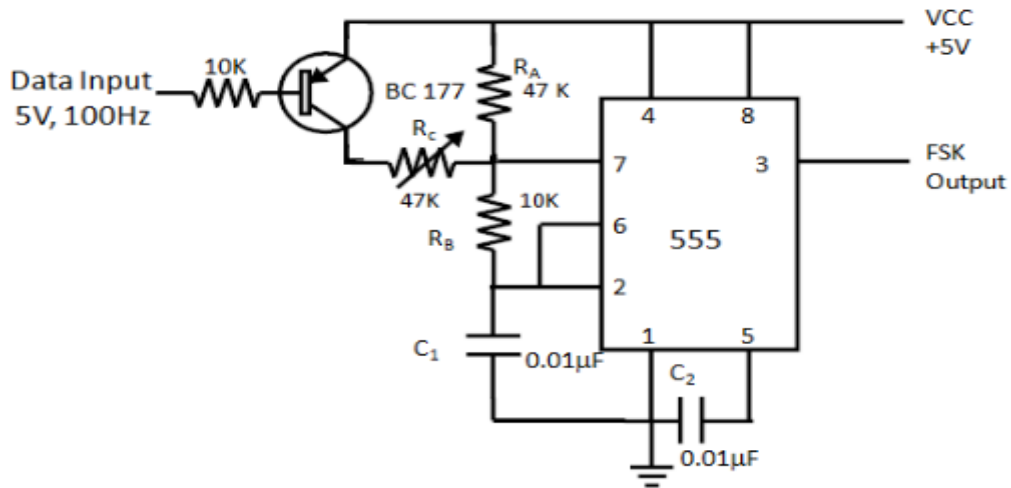
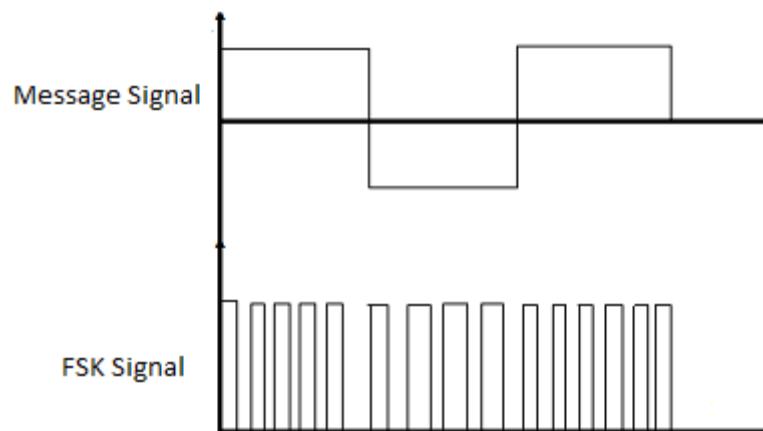


Fig.FSK Modulator

Waveforms:



Result:

The FSK modulator circuit was set up and the waveforms were observed and plotted.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No.

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Date:

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BPSK MODULATOR

Problem Statement:

Construct Binary Phase Shift Keying (BPSK) modulator circuit and observe the waveforms.

Components & Equipment Required:

Sl. No.	Item & Specification	Quantity
1	Transistor- SL100, SK100	1
2	Resistor- 1K 10K	2 4
3	IC 741	1
4	Signal Generator	2
5	DSO	1
6	Bread Board	1
7	Power Supply - $\pm 15V$	1
8	Wires and probes	

Theory:

Binary Phase Shift Keying (BPSK) is digital transmission scheme where the binary data is transmitted using out of phase signals. A simple BPSK modulator circuit using an NPN-PNP transistor pair and an Op amp is shown in figure. The transistors work as switches and the Op amp works as inverting/noninverting amplifier. The carrier signal is fed to the collectors and the message signal is fed to the bases of the two transistors simultaneously. The emitters of the transistors are grounded. When the message signal is at logic '1' (+5V), the NPN transistor is ON and works as a closed switch. The PNP transistor is OFF and works as an open switch. The Op amp now works as a noninverting amplifier with the carrier signal fed to its non-inverting input. The carrier signal reaches the output without any phase shift. When the message signal is at logic '0' (-5V), the NPN transistor is OFF and the PNP transistor ON. The Op amp works as an inverting amplifier with the carrier signal fed to its inverting pin. The carrier signal now reaches the output with 180o phase shift. Thus the carrier signal switches its phase as the message signal switches between '0' and '1'. The resulting output is BPSK modulated.

Procedure:

- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the modulator circuit as per the circuit diagram. Switch on the power supplies
- Feed the 2Vpp, 1KHzsinusoidal signal as carriers and the 10Vpp, 200Hz square wave signal as data input.

- Observe both the message input and BPSK output simultaneously on DSO. Plot the waveforms

Circuit Diagram:

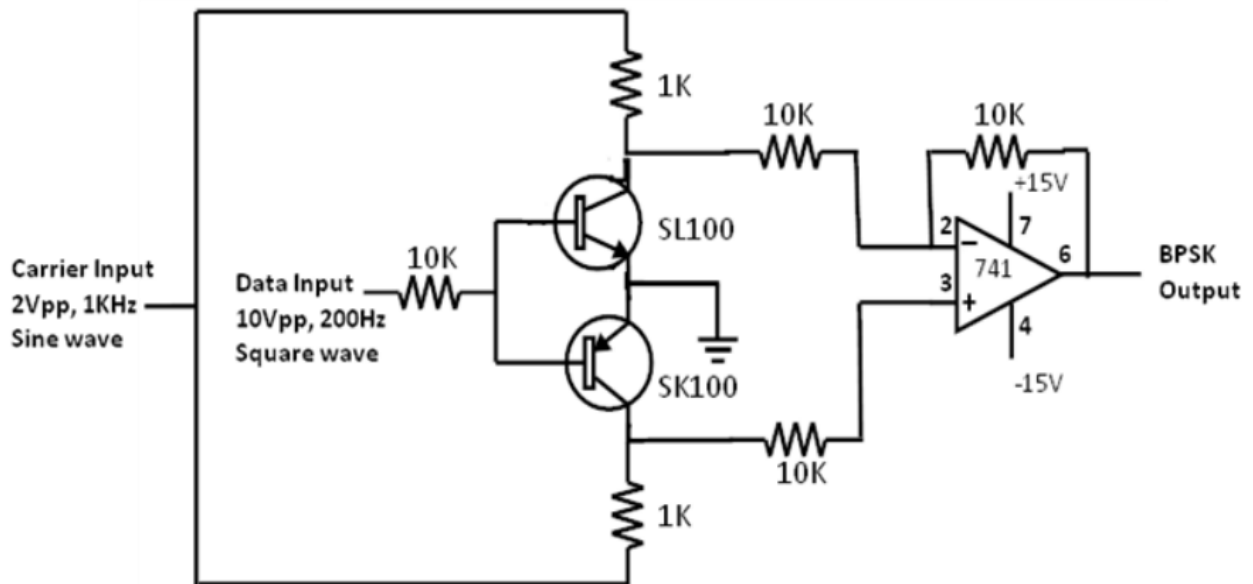
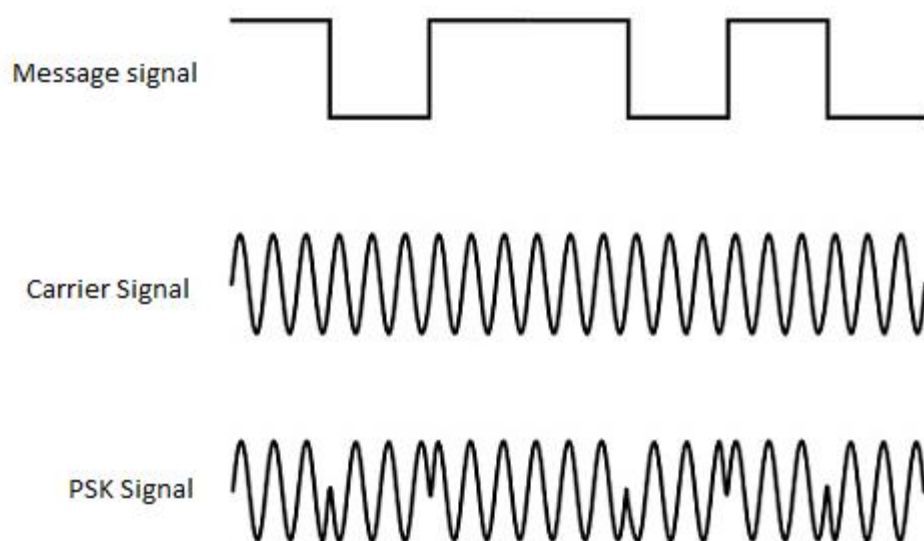


Fig.BPSK Modulator

Waveforms:



Result:

The BPSK modulator circuit was set up and the waveforms were observed and plotted.

Instructions by the Faculty:

For Office use only	Signature	Remarks
Result verified by the faculty		
Rough record verified		

Exp No. Date:

TIME DIVISION MULTIPLEXER

Problem Statement:

Construct Time Division Multiplexer (TDM) circuit and observe the waveforms.

Components & Equipment Required:

Sl. No.	Item & Specification	Quantity
1	Transistor- SL100, SK100	1
2	Resistor- 1K	2
	10K	4
3	IC 741	1
4	Signal Generator	3
5	DSO	1
6	Bread Board	1
7	Power Supply - $\pm 15V$	1
8	Wires and probes	

Theory:

Time Division Multiplexing (TDM) is widely used in digital communication networks to transmit multiple signals simultaneously through the same channel. Different signals are transmitted in a time shared manner

A simple TDM multiplexer circuit using an NPN-PNP transistor pair and an Op amp is shown in figure. The transistors work as switches and the Op amp works as an adder. The signals to be sent are fed to the collectors of the two transistors. The switching signal is applied to the bases the transistors. During the ON time of the switching signal, the NPN transistor is ON and the PNP transistor is OFF. Signal 1 alone is connected to the adder input and reaches the output. During OFF time of the switching signal, the NPN transistor is OFF and the PNP transistor is ON. Signal 2 alone is connected to the adder input and reaches the output. Thus the two signals reach the output one after the other as the switching signal changes state. The resulting signal is a time division multiplexed one.

Procedure:

- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the circuit as per the circuit diagram. Switch on the power supplies
- Feed the 5Vpp, 2 KHz square wave signal as the switching input and 2Vpp, 100Hz sine wave as signal 1 and 2Vpp, 100Hz square wave as signal 2.
- Observe TDM output on DSO. Plot the waveforms.

Circuit Diagram:

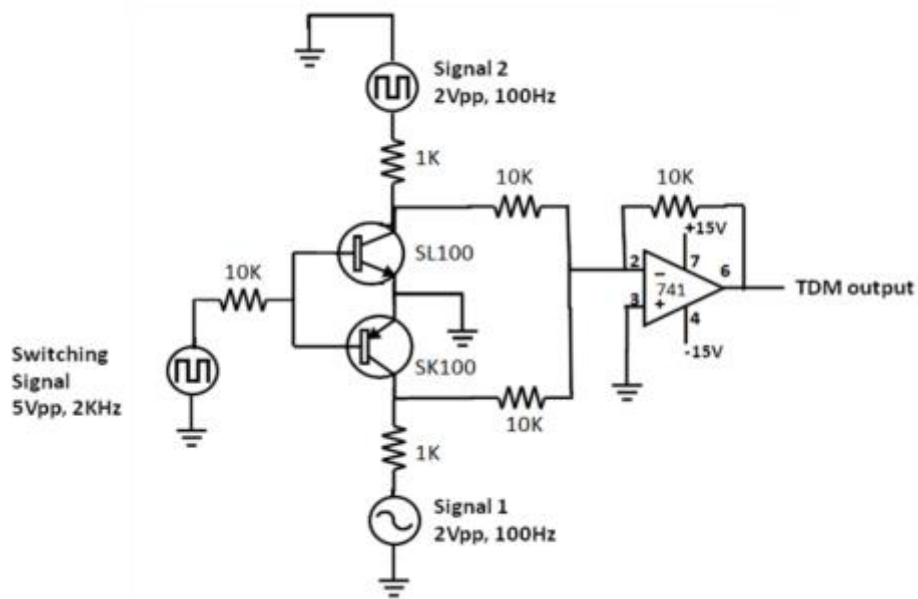
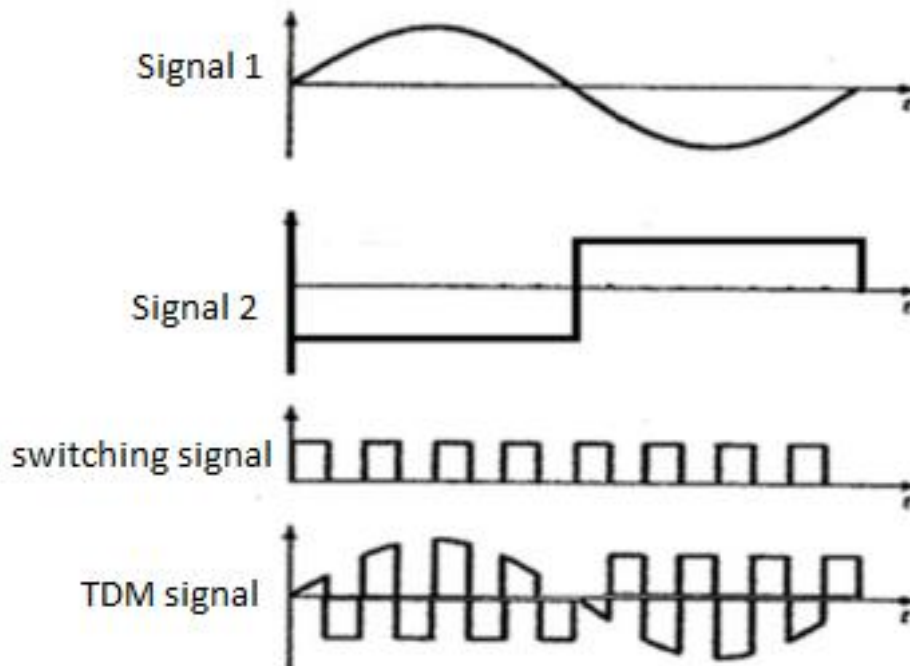


Fig.TDM Multiplexer

Waveforms:



Result:

TDM Multiplexer circuit was set up and the waveforms were observed and plotted.

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Rough record verified		

Exp No. Date: **TRANSISTOR MIXER****Problem Statement:**

To set up a transistor mixer circuit to produce IF from RF and oscillator frequency inputs

Components & Equipment Required:

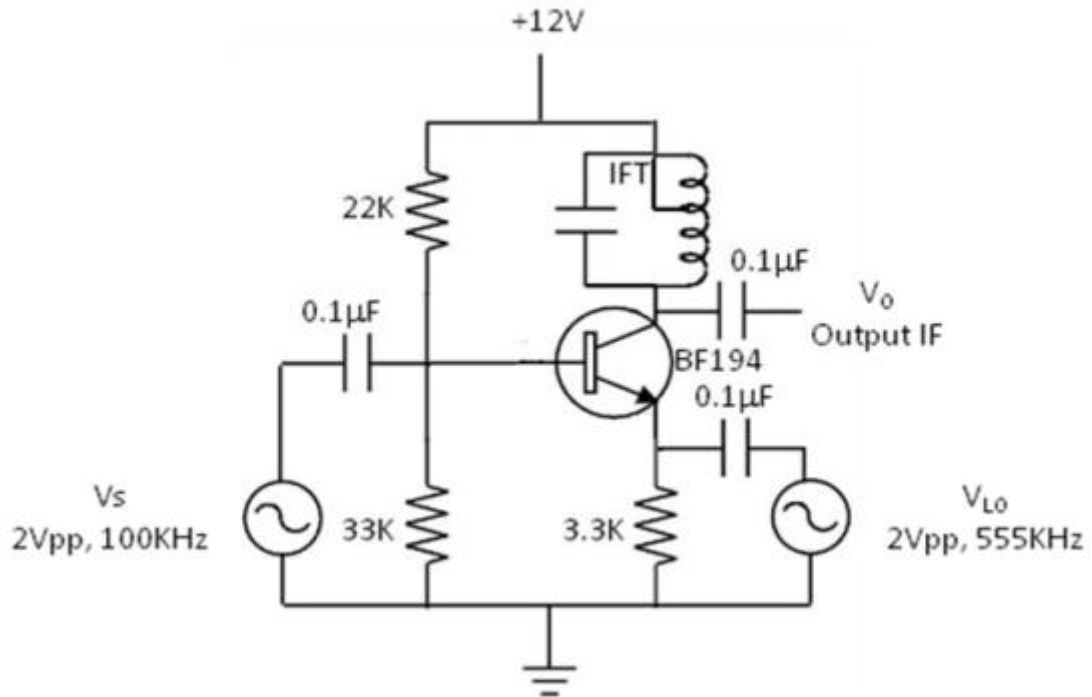
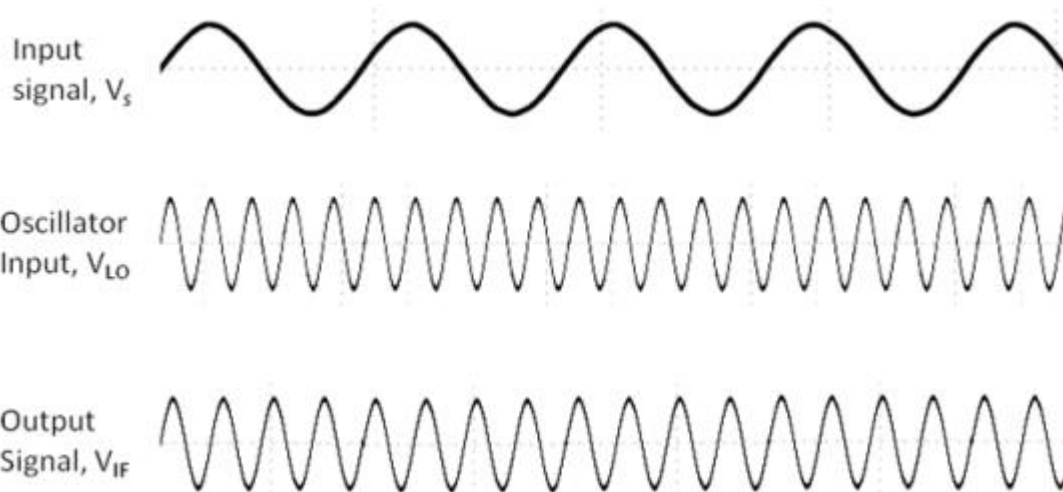
Sl. No.	Item & Specification	Quantity
1	Transistor- BF194	1
2	Resistor- 22K, 33K, 3.3K	1 each
3	Capacitor 0.1 μ F	1
4	IFT	1
5	Signal Generator	2
6	DSO	1
7	Bread Board	1
8	Power Supply - 12V	1
9	Wires and probes	

Theory:

Mixer or frequency converter is actually a nonlinear resistor having two sets of input terminals and one set of output terminal. The two inputs to the mixer are the input signal and the local oscillator signal. The output of the mixer contains many frequencies including the sum and difference frequencies between the two input signals. The mixer output is commonly tuned to the difference frequency. This frequency is called the intermediate frequency (IF).

Procedure:

- Follow precautions for personal and equipment safety.
- Check all components, equipment and signal probes.
- Set up the circuit as per the circuit diagram. Switch on the power supplies.
- Check the dc conditions of the transistor and make sure that it is working in the active region.
- Feed a 2Vpp, 100 KHz sine wave signal at the base of the transistor as shown in figure.
- Feed a 2Vpp, 555 KHz sine wave signal at the emitter of the transistor as shown in figure.
- Observe the output waveform on a DSO and measure the frequency. Adjust the IFT to obtain 455 KHz as the peak output frequency.
- Observe inputs & output on DSO. Plot the waveforms.

Circuit Diagram:**Waveforms:**

Result:

TDM Multiplexer circuit was set up and the waveforms were observed and plotted.

Instructions by the Faculty:

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Rough record verified		

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