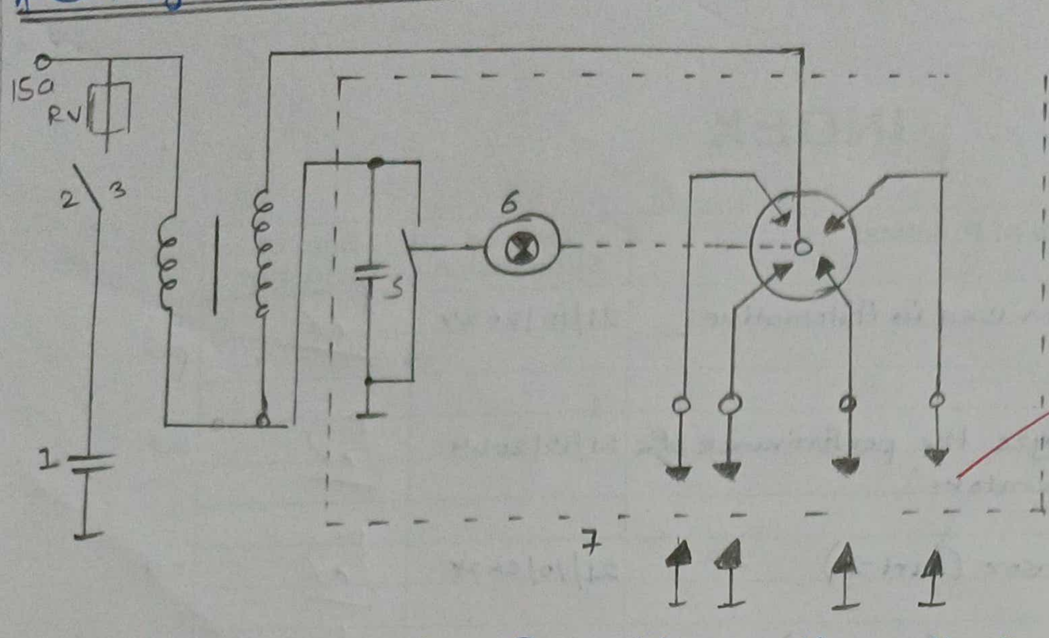
## *Coil Ignition with contact control*




1) Battery
2) Ignition Switch
3) Ignition coil.
4) Ignition Capacitor
5) Ignition distributor
6) Distributor cam.
7) Spark plugs.

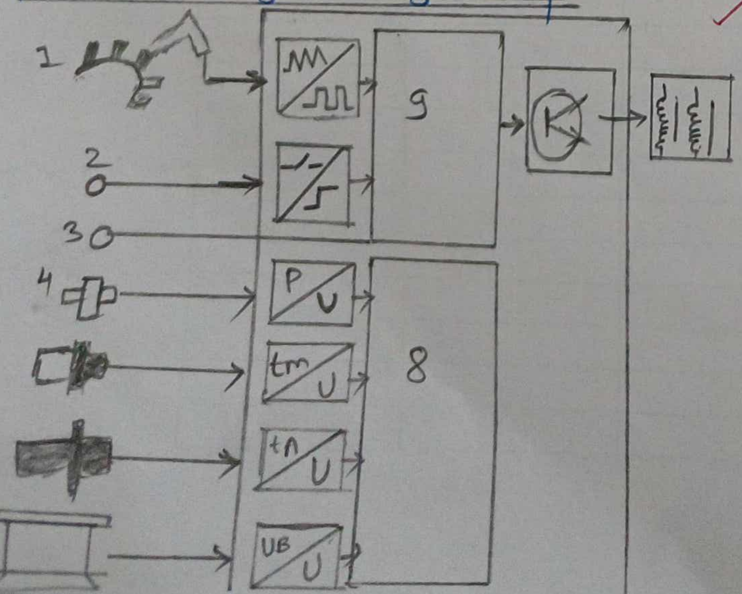
RV: Series resistor for raising starting voltage.

## *Transistor Ignition System*

**1) Inductive sensor:-** The inductive sensor is a permanently excited AC generator comprising a stator and a rotor. It's tooth or spike cant is equal to the engines cylinder current. The frequency of the generated AC voltage and its amplitude depend on the selected engine speed voltage processed by switch gear and used for ignition control.

**2) Hall sensor:** Ignition pulses make use of Hall effect: In a semiconductor layer a conducting a current, a speed-dependent magnetic field produces voltage pulses which causes the switchgear to activate and deactivate the primary current. They do not suffer from wear and thear for require maintenance. Futhermore, their ignition point can be adjusted very precisely to optimise engine operation.

## *Electronic Ignition System*




1) Engine Speed.
2) Switch signals
3) Serial CAN BUS.
4) Suction pipe pressure.
5) Engine temperature.
6) Intake air temperature.
7) Micro computer
8) Battery voltage.
9) Analog to Digital converter.
10) Power stage.

# PRACTICAL NO: 1

Date : 4/09/2024

TITLE : Ignition system used in Automative Electronics.

AIM / OBJECTIVE: To study and analyze performance of ignition system used in Automative Electronics.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

S04203-2A - Unitrarn-1 Interface

S04203-40 - Unitrain-1 Ignition system board.

S04203-25 - Unitrain-1 measurement accesories.

LN 9036 - Peak Tech TK-100 test probe 1:10.

CONCEPT / THEORY OF EXPERIMENT:

Ignition system is a system in an internal-combustion engine that produces the spark to ignite the mixture of fuel and air includes the battery, ignition coil, distributor, spark plugs and associated switches and wiring.

PROCEDURE :

1) Open labsoft.
2) Read the overview.
3) Do the connections as per shown in circuit.
4) Follow the procedure as given.
5) Get waveforms if needed.
6) Answer questions.
7) Repeat step 3 to 6 for all the experiments.

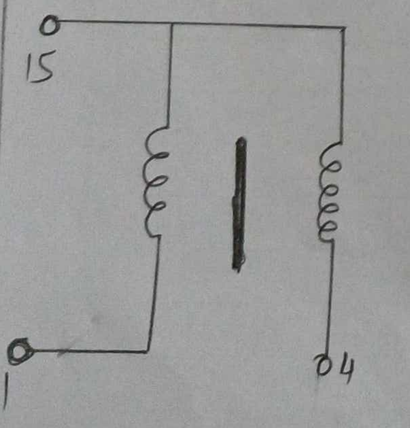
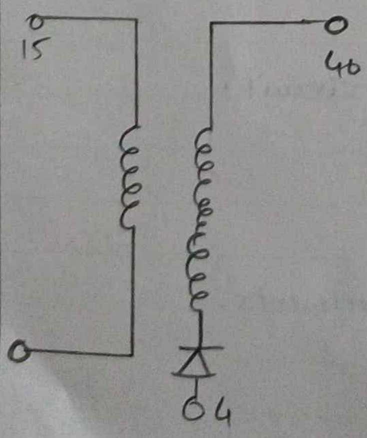
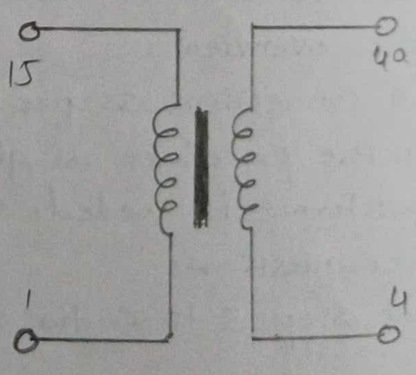
| Ignition system | Coil ignition | Transistor ignition | ECU | |
|---|---|---|---|---|
| | | | Semi Electronic ignition | Fully electronic ignition |
| High voltage generation | Inductive | | | |
| Ignition mechanism | Mechanical | | Electronic | |
| Determination of ignition angle from engine speed and load. | Mechanical | | Electronic | |
| Distribution and transfer of ignition spark to correct cyclinder. | Mechanical | | Electronic | |

## *Components of Ignition System :-

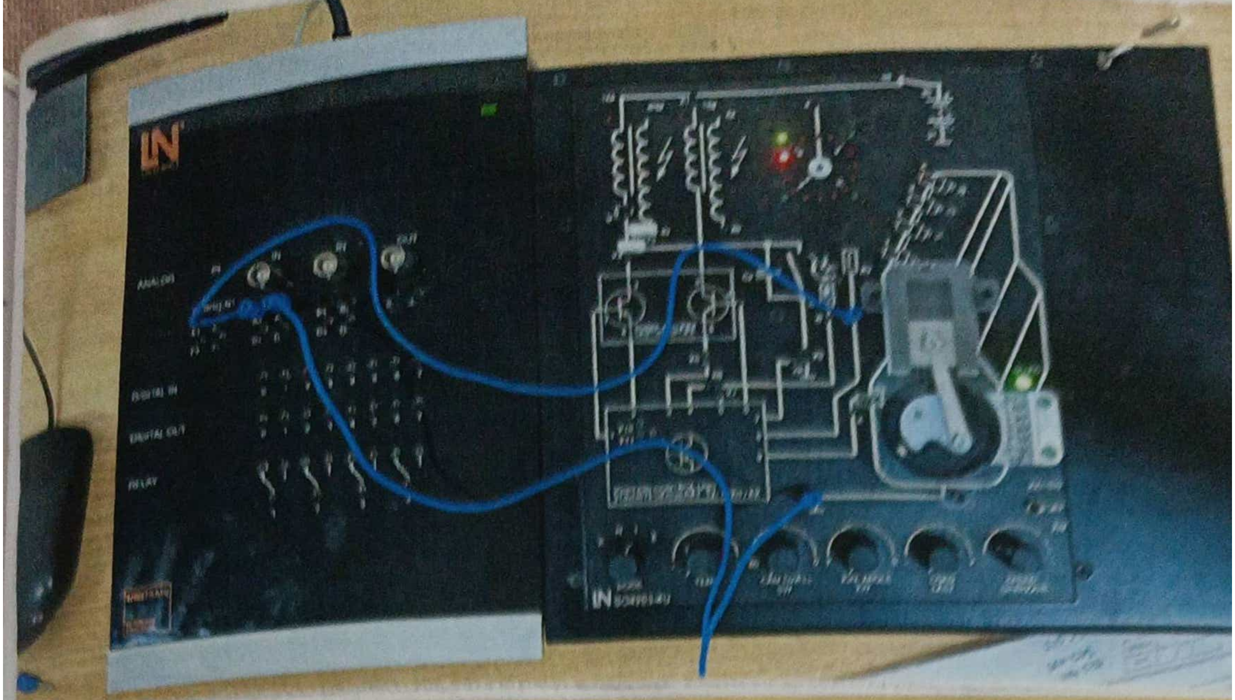
1) Battery
2) Ignition switch
3) Ignition coil
4) Ignition Capacitor.
5) Ignition distributor.
6) Distributor cam.
7) Spark plugs.

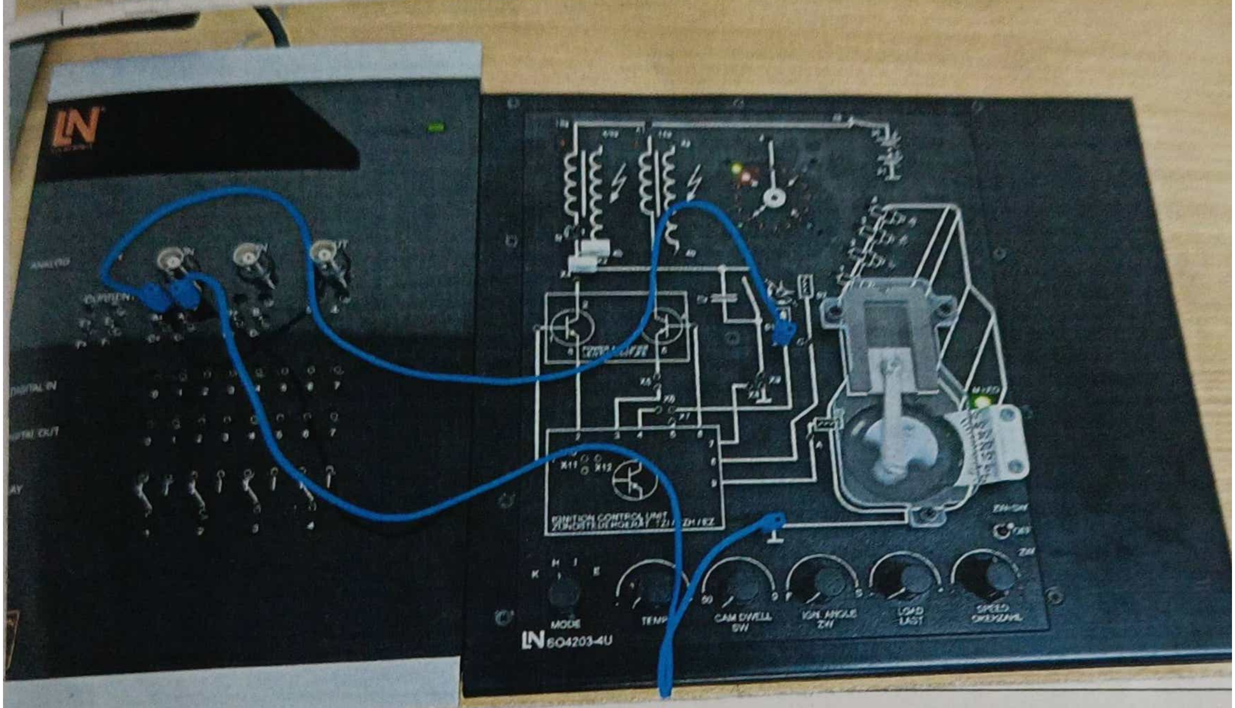
***Ignition Voltage:-** The electrode spacing should be large enough for the spark to ignite a high volume so as to form a stable flame core and reliably combust the fuel-air mixture. The required ignition voltage level depends on the electrode spacing and shape, temperature, electrode material, as well as combustion-chamber parameter like mixture composition, flow rate, turbulance & density of the gas to be ignited.

## * Ignition Coil Types:-

| Rotary distribution with a singlespark ignition coil. | Static distribution with a single spark ignition coil. | Static distribution with dual spark ignition coil. |
|---|---|---|
|  |  |  |

02






**Oscilloscope trace**

* Transister Ignition (Inductive sensor)

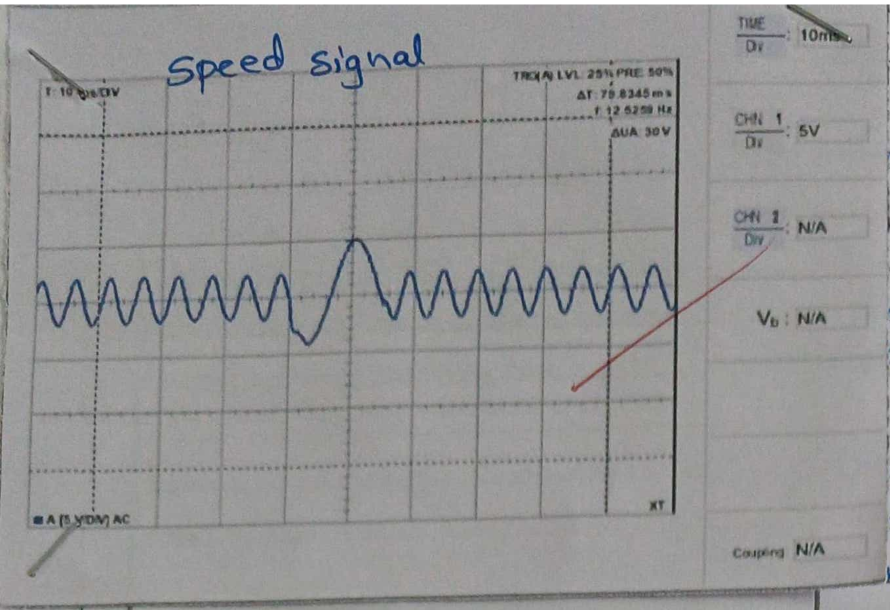
TIME/Div: 10ms

CHN 1/Div: 2V

CHN 2/Div: N/A

$V_D$: N/A

Coupling: N/A

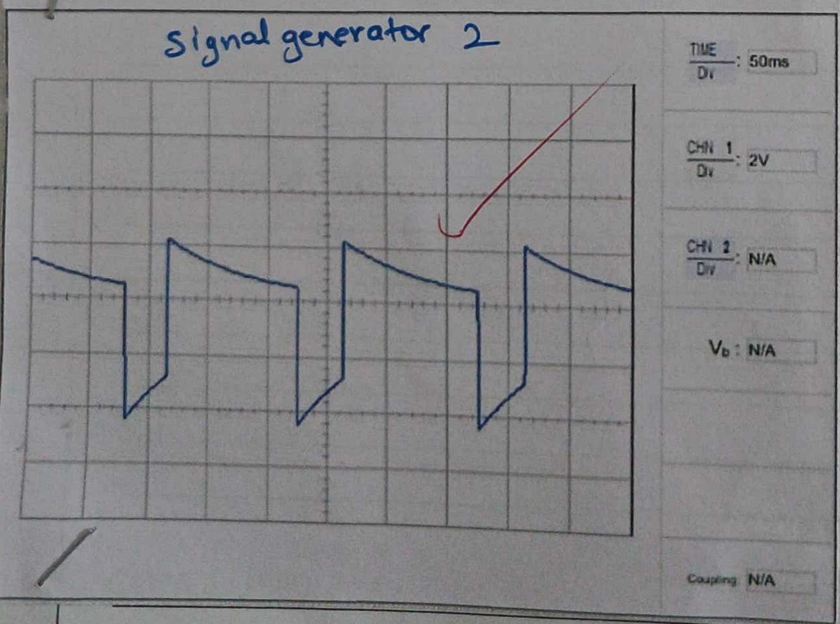



... System.

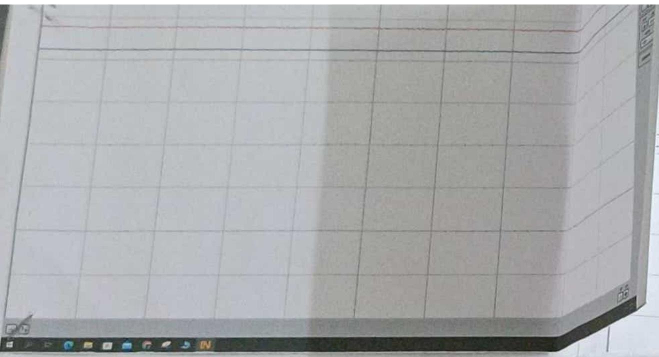
| | Disadvantages |
|---|---|
| | ...enerally higher cost of development ... components. |
| | ...andard components often cannot ... used due to manufacturer specific ...ngine design. |
| Low radio interference due to an absence of sparks outside the combustion chamber. | |
| Low Noise. | |
| Accurate signal processing by ECM (Electronic control module). | |

RESULTS :

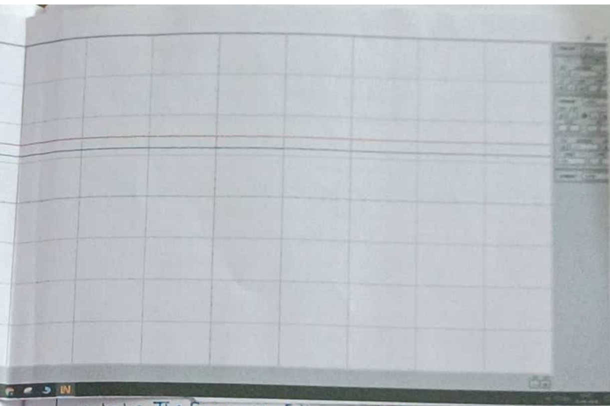
Oscilloscope trace

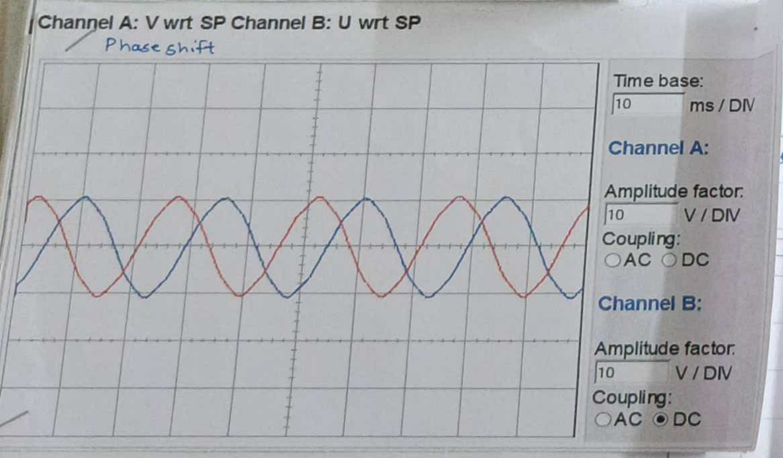



Hence, we finally studied performance of various ignition systems.



e at no load:





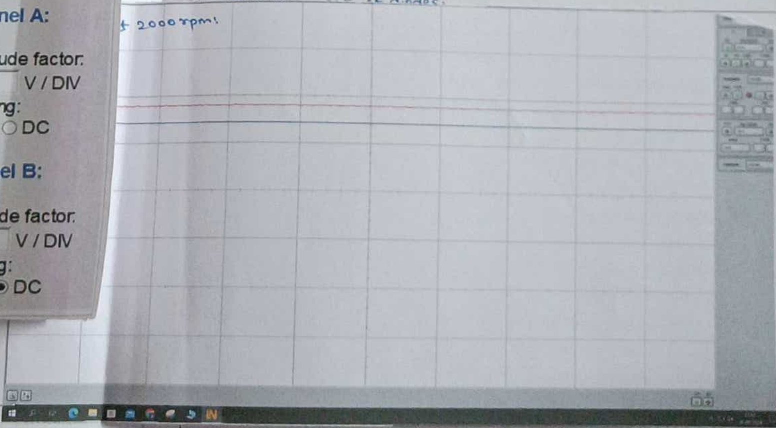

to the rest of
e phase windings
have shifted with

a.

3 pole pairs

no half wave is missing. The frequency of the output of the rectifier is twice as high as the frequency at the input. The amplitude of the output signal is somewhat lower then the amplitude of input signal due to the voltage drop of approx. 1.4 volts across the ... of diodes.

t 2000 rpm:



...ing current to
through the
voltage.

approx 1.4 higher
diodes. The
rotor current
.7V drop per

OBSERVATIONS

1) Phase Shift :- As the phase winding are connected permanently to the rest of generator and the on-board system, the voltage measured at the phase windings tend to reassimble a sine wave. The three phases are regularly phase shifted with respect to each other at 120°.

2) Determining the period or duration of a generation revolution :-
2000 revs corresponds to 60s.
1 rev corresponds to 0.03s.
tcalc = 30 ms
n = tcalculated / treading
n = 30ms / 10ms = 3
The generator on the Unitrain "Three-phase generator" card has 3 pole pairs.

3) From bridge rectifier :- In this case of a smoothed voltage no half wave is missing. The frequency of the output of the rectifier is twice as high as the frequency at the input. The amplitude of the output signal is somewhat lower then the amplitude of input signal due to the voltage drop of approx. 1.4 volts across the respective pair of diodes.

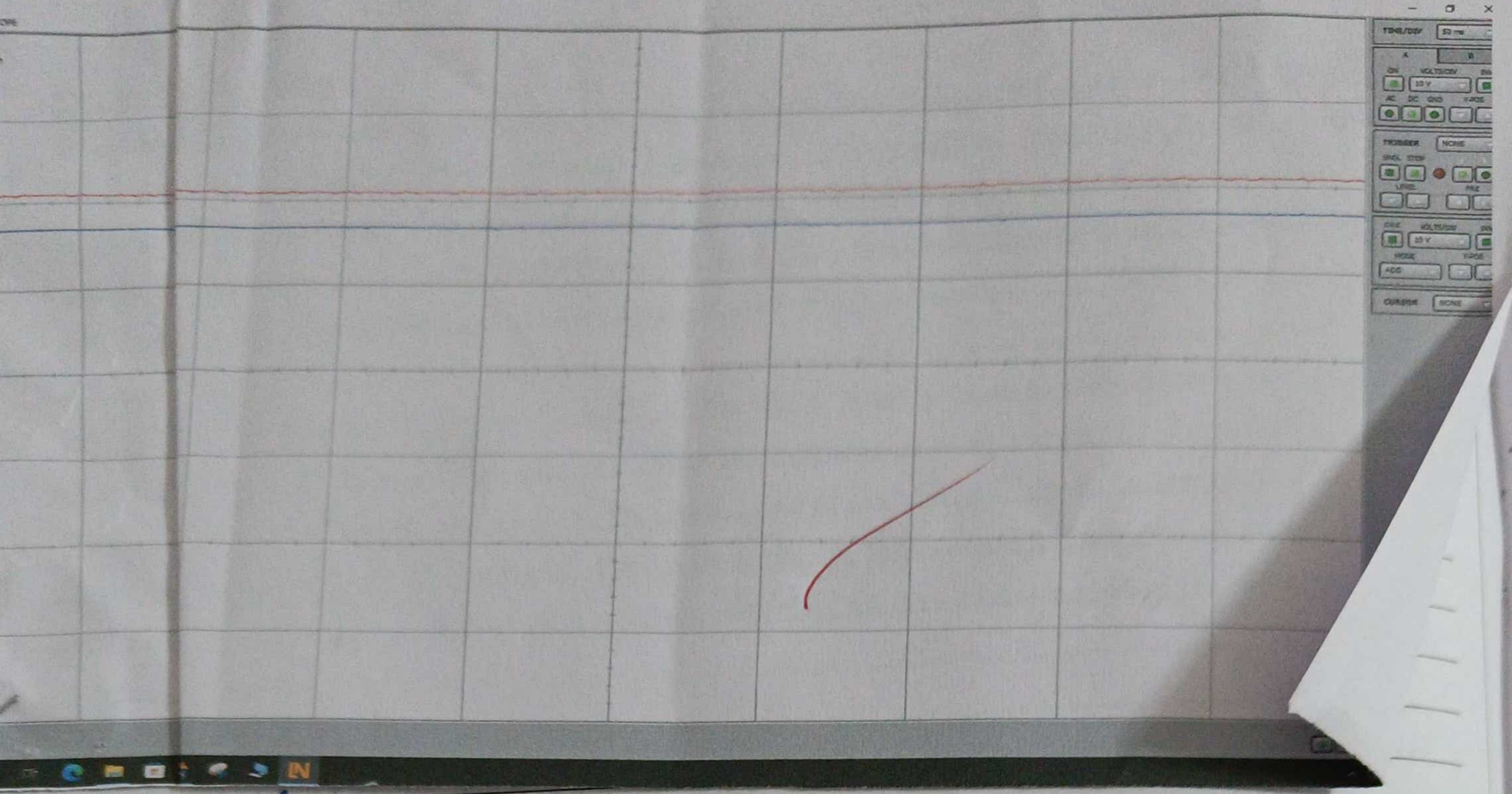
4) Changing current experiment :

| Generator speed | Battery voltage | change control lamp |
|---|---|---|
| No-load : | 12.4 V | OFF |
| 800 rpm : | 15.5 V | ON |

∴ The change control lamp light's up when the battery is supplying current to the on-board network. In order for a charge current to flow through the battery, the battery voltage must be lower than the generator voltage.

5) Voltage drop exitement :- The peak voltage of phase winding V is approx 1.4 higher than the battery voltage. This is the voltage drop across the diodes. The voltage differential aries from the following reasons. The generator current continuously flows through two diodes and there is an approx 0.7V drop per diode.

e at 3000 rpm:



RESULTS :

We have studied the phase shift & pole pairs in three phase generator, bridge rectifier and rectified voltage, charging current and voltage drop as ~~the~~ well as the integrated regulator and discrete regulator.

CONCLUSION :

Hence, we have understood, studied and analyzed the working of alternator and generator used in vehicles.

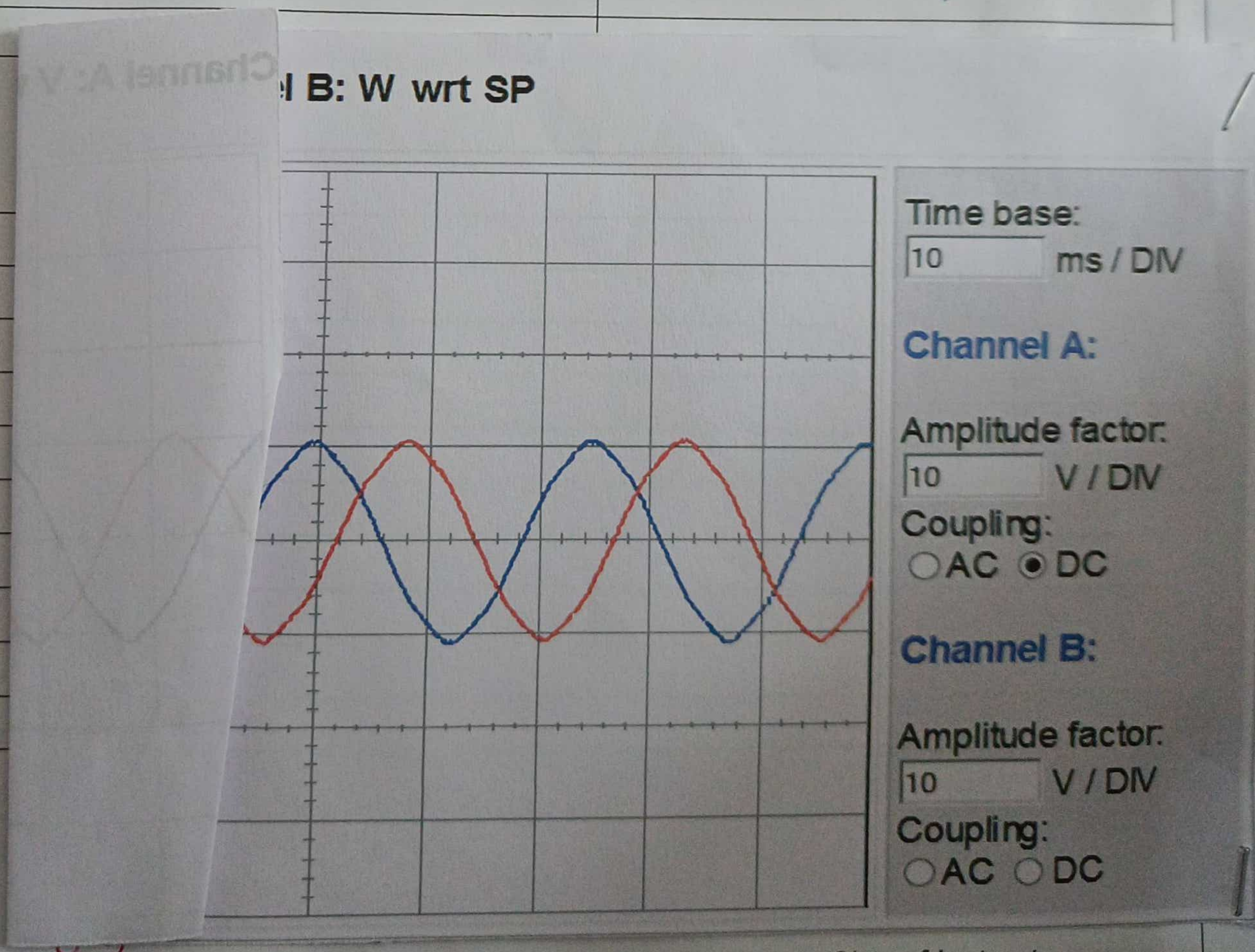
**Assessment Parameters (To be filled by Instructor)**

1. Successful completion of Practical ( Y/N)
2. Time taken ( hours / minutes ) : 2 Hr.

**3. List other Parameters & Outcomes :**

| Sr. No. | Parameter | Outcome (Achieved / Not Acheived) |
|---|---|---|
| 1) | Ability to do connections as per LH course. | Y |
| 2) | Ability to perform the experiment as per LN course. | |
| 3) | Ability to verify the output of each experiment as per the theory in the corresponding LN courses. | |
| | | |
| | | |

Remarks :




Total marks ______ out of 10.

Sign of Instructor

Date : 2/10

# PRACTICAL NO: 3

Date : 16/10/24

TITLE : Automative Sensors (Part-1)

AIM / OBJECTIVE: To verify & analyze performance of NTC, PTC, knock sensor.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

CO4204-7F sensor board
Multi 35 digital multimeter
Unittrain cards
Unitrain Interface.

CONCEPT / THEORY OF EXPERIMENT:

An NTC sensor is negative temp coefficient and when the temp increases resistance decreases.
An PTC sensor is positive temp coefficient sensor in this when the temp increases resistance also increases.

PROCEDURE :

A) NTC sensor.

1) Turn on board ~~power~~ supply.
2)

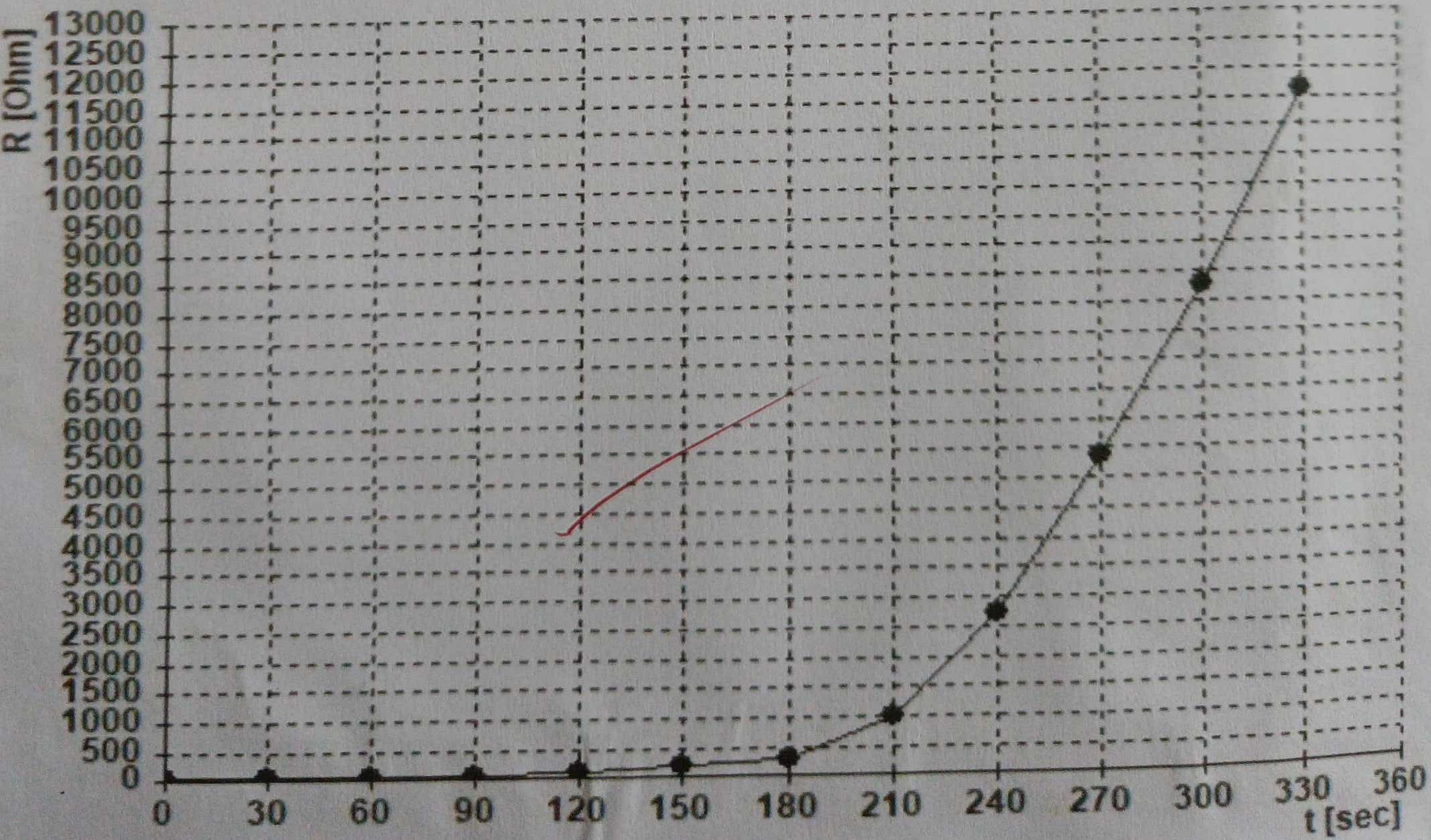
| From | to |
|---|---|
| Multimeter ohm | NTC pin 1 |
| Multimeter gnd | NTC pin 2 |

3) Using multimeter, measure NTC temp of room temp.
4) Turn on the heater & observe the resultant reading on multimeter.
5) Once completed turn off the heater.

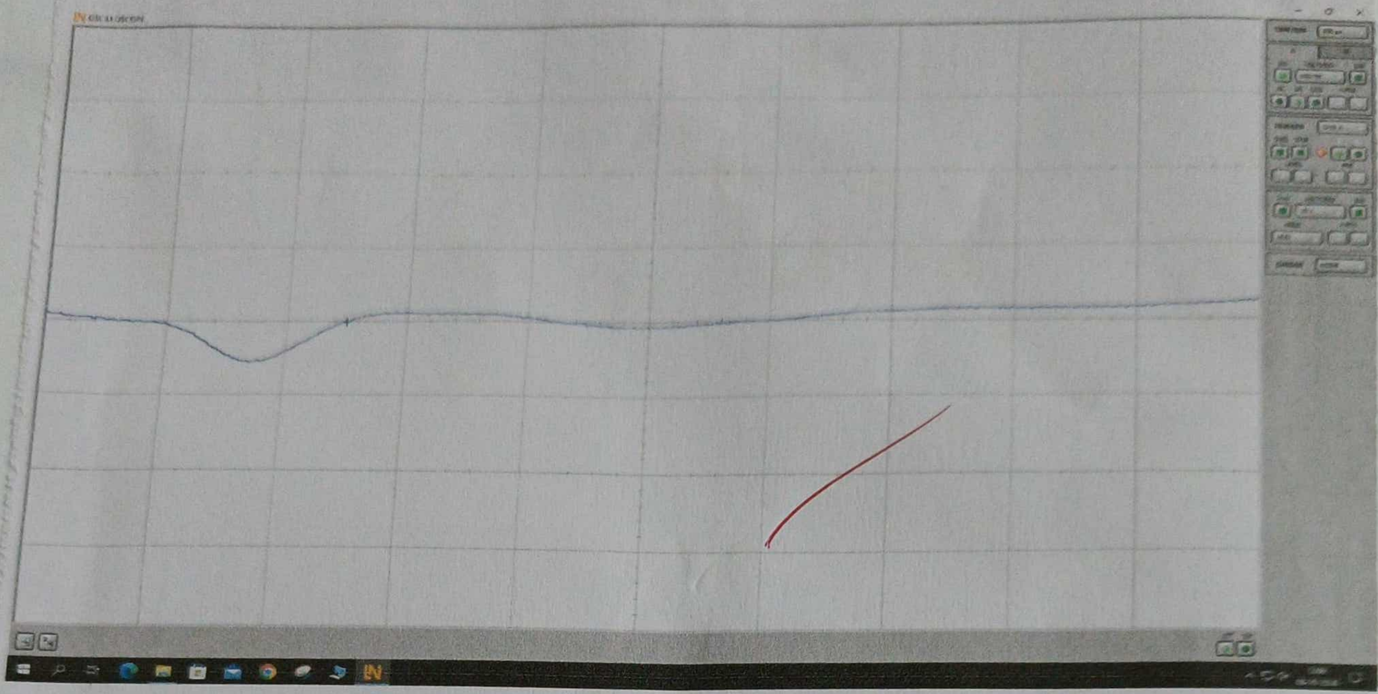
## PTC Sensor Readings: -

| t/sec | R/Ohm |
|---|---|
| 0 | 52.50 |
| 30 | 53.90 |
| 60 | 60.70 |
| 90 | 79.00 |
| 120 | 115.50 |
| 150 | 190.00 |
| 180 | 315.00 |
| 210 | 1012.00 |
| 240 | 2742.00 |
| 270 | 5360.00 |
| 300 | 8260.00 |
| 330 | 11620.00 |

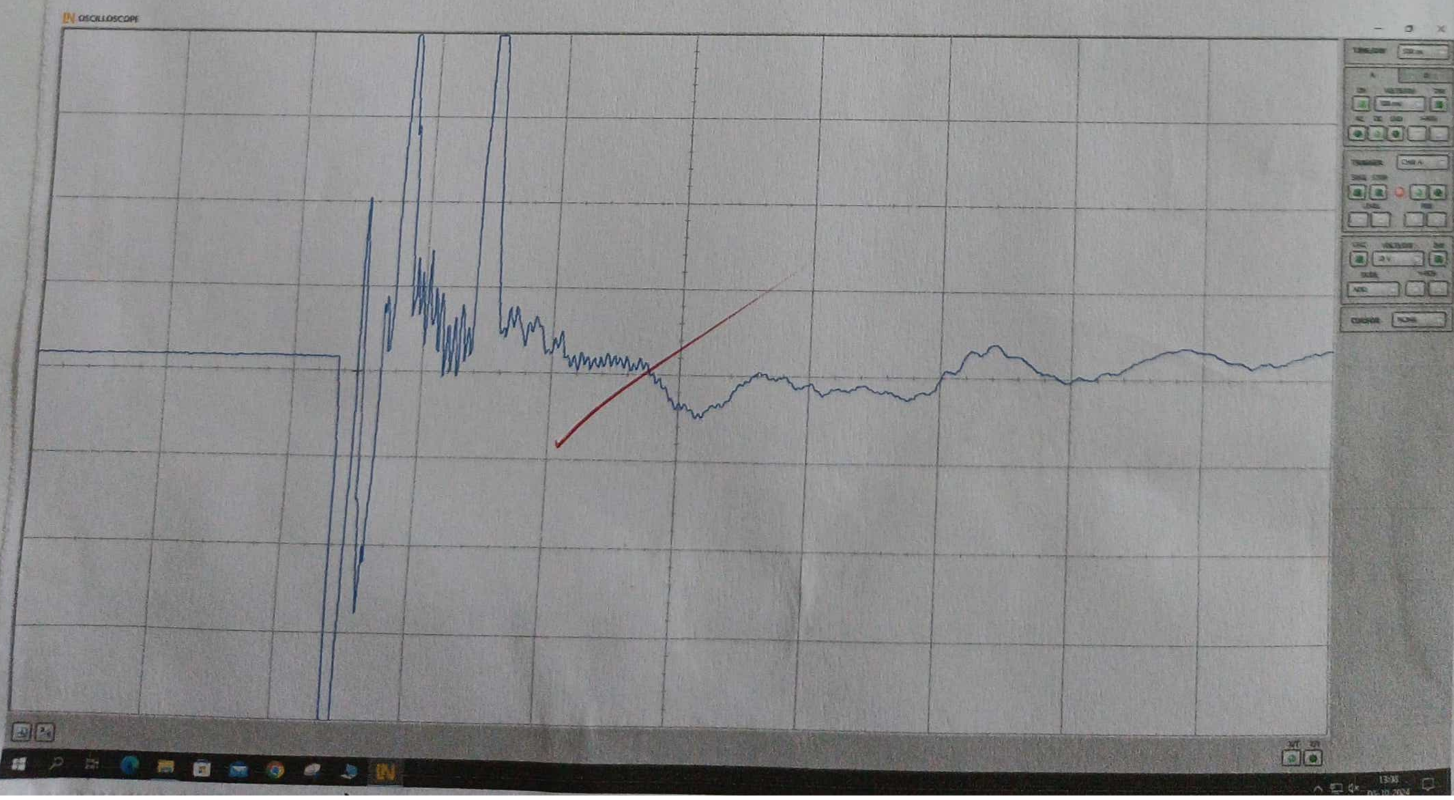
## PTC Graph: -



## Knock Sensor (Soft Object): -



## Knock Sensor (Hard Object): -



OBSERVATIONS

B] PTC

1) Assemble the circuit and use multimeter to measure the resistance.

2)

| Form | To |
|---|---|
| Multimeter ohm | PTC pin 1 |
| Multimeter gnd | PTC pin 2 |

3) Turn on the heater.

4) Observe the resultant reading on multimeter.

5) Note down the readings and turn off heater.

C] Knock sensor.

1) Set up the exp.

2) Open oscilloscope on LN.

3)

| From | To |
|---|---|
| Interface A+ | knock sensor pin 1 |
| Interface A - | knock sensor pin 2 |

4) Oscilloscope settings:.

Channel A : 500 mv/div

channel B : OFF

Time Base : 500 us/div

Mode : XIT, DC, single

Trigger : channel A, Rising edge, Pre trigger 25%.

5) Start the oscilloscope, strike the knock sensor firmly and another time harly & observe the waveforms on oscilloscope.

CALCULATIONS :

Resistance of NTC at room temp = 8.38 K-Ω

Resistance of PTC of room temp = 0.0558 K-Ω

Resistance of PTC offer heating = 5.28 Ω

Applications:

A) NTC:

1) Tire curing

2) To monitor and control engine temp.

B) PTC:

1) It is used in place of fuse for circuit problem.

c) knock sensor:

1) Pre-ignition knocking in car engine.

2) Monitor spin bearings.

RESULTS :

NTC: Temp increases resistance decreases.

PTC: Temp increases resistance increases.

knock sensor: As the higher the strike on knock sensor the higher the waveform on the oscilloscope.

CONCLUSION :

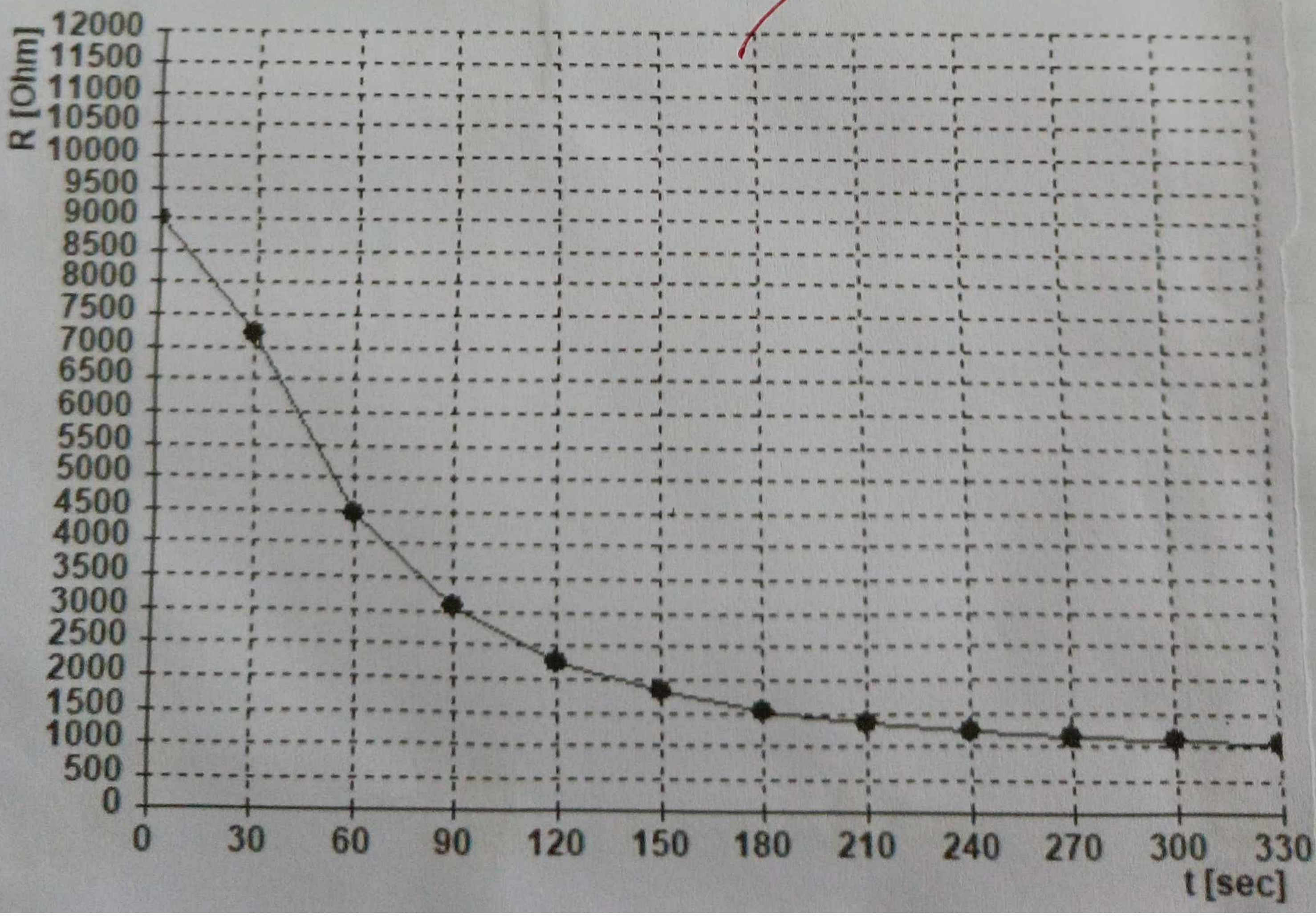
Hence, successfully performed this practical of NTC, PTC, knock sensor.

**NTC Sensor Readings: -**

P-3

| t/sec | R/Ohm |
|---|---|
| 0 | 9000.00 |
| 30 | 7210.00 |
| 60 | 4460.00 |
| 90 | 3060.00 |
| 120 | 2246.00 |
| 150 | 1822.00 |
| 180 | 1540.00 |
| 210 | 1364.00 |
| 240 | 1241.00 |
| 270 | 1160.00 |
| 300 | 1090.00 |
| 330 | 1045.00 |

**NTC Graph: -**



# PRACTICAL NO: 4

Date : 16/10/24

TITLE : Automotive Sensor (Part - II)

AIM / OBJECTIVE: To verify and analyze the performance of the Hall sensor, Inductive sensor.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

CO4204-4 Sensor board

Multimeter

UniTrain.

CONCEPT / THEORY OF EXPERIMENT:

The Hall sensor main purpose is to precisely reference the first cylinder in co-ordination with the camshaft sensor. The hall effect refers to the occurance of an electric field when a conductor carrying an electric current field when a conductor carrying an electric current is possitoned.

PROCEDURE :

A) Hall Sensor.

1) Set up exp & mount the hall sensor & let the motor run slowly.

2) Connect the hall sensor on the board

| From | To |
|---|---|
| 5V | pin 1 |
| Interface A+ | Hall sensor pin 1 |
| Interface A- | Hall sensor pin 2 |

3) Measure the Hall sensor connected signal & supply voltage using voltmeter A.

4) Voltage around hall sensor should be 5V.

5) The signal voltage are from 0.7 V to 4.38 V

HALL SENSOR – NO RPM


Time base:
100_____ ms / DIV

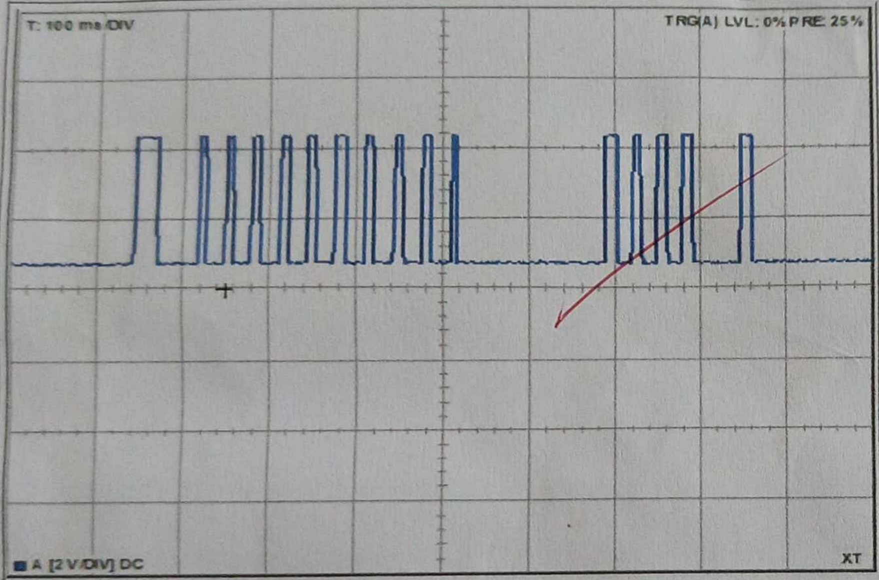
**Channel A:**

Amplitude factor:
2_______ V / DIV
Coupling:
○ AC ○ DC

**Channel B:**

Amplitude factor:
_________ V / DIV
Coupling:
○ AC ○ DC

HALL SENSOR – MEDIUM RPM (50%)




Time base:
100_____ ms / DIV

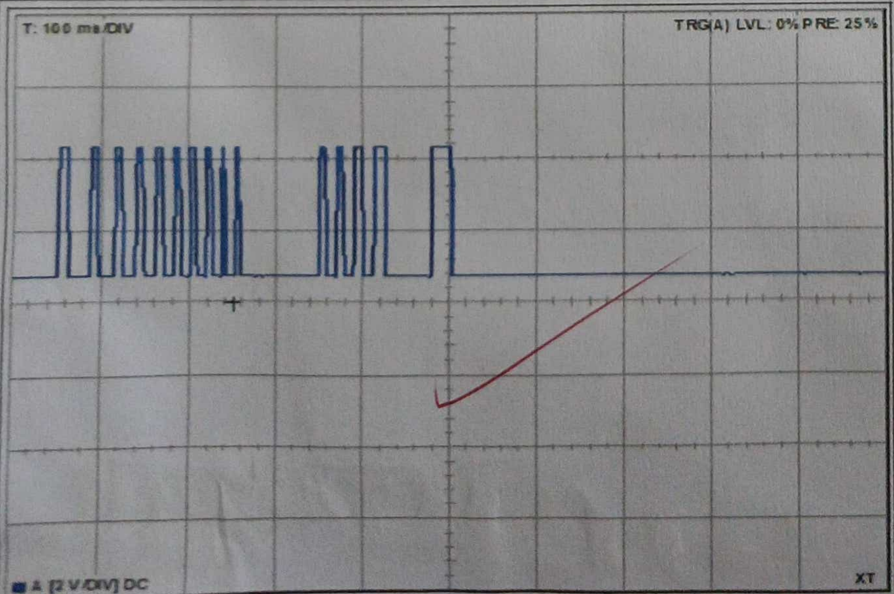
**Channel A:**

Amplitude factor:
2_______ V / DIV
Coupling:
○ AC ○ DC

**Channel B:**

Amplitude factor:
_________ V / DIV
Coupling:
○ AC ○ DC

HALL SENSOR – MAXIMUM RPM (100%)




Time base:
100_____ ms / DIV

**Channel A:**

Amplitude factor:
2_______ V / DIV
Coupling:
○ AC ○ DC

**Channel B:**

Amplitude factor:
_________ V / DIV
Coupling:
○ AC ○ DC

OBSERVATIONS

6) Open the virtual oscilloscope.

Settings: Channel A : 2V/div
Channel B : off
Time base : 100ms/div
Mode : X/T, DC
Trigger : Channel A / Rising Edge / Pre-trigger 25%.

B] For inductive Sensor:

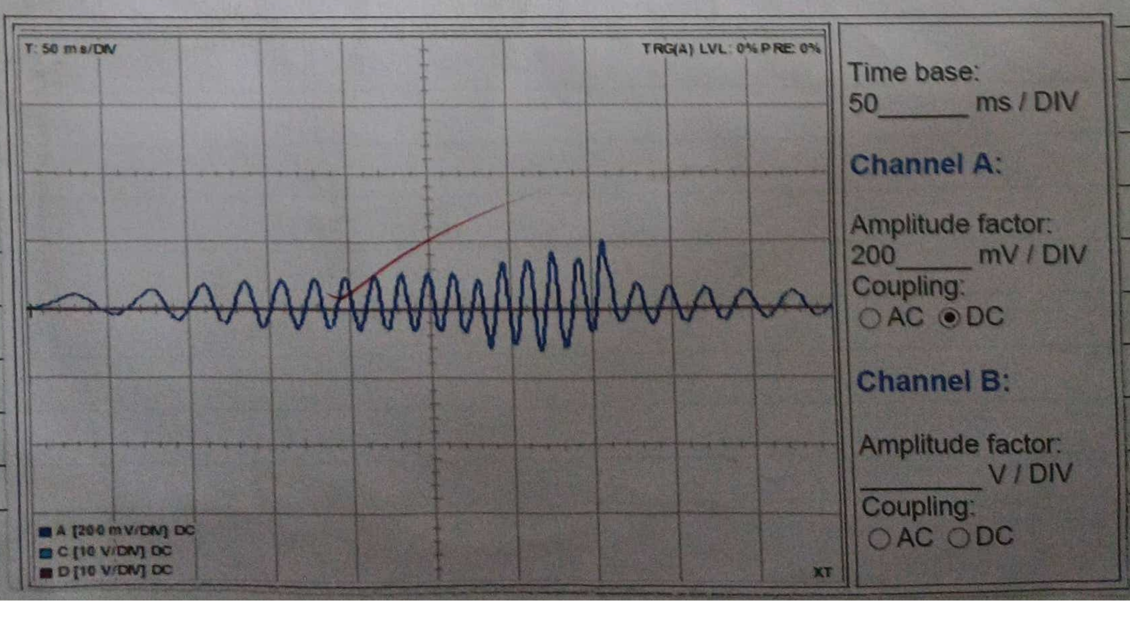
1) An inductive sensor can be connected to an oscilloscope.
2) Sensor signal observed as the gear run turns connected to the inductive sensor.
3) Connections:

| From | To |
|---|---|
| Interface A+ | Inductive pin 1 |
| Interface A- | Inductive sensor pin 2 |

4) Open oscilloscope on LN.
5) Oscilloscope settings:

Channel A : 200mV/div
Channel B : off
Time Base : 500ms/div
Mode : X/T, DC
Trigger : Channel A, Rising edge

INDUCTIVE SENSOR - NO RPM



CALCULATIONS :

• For Hall Sensor:

Determining the max speed in RPM ; for this purpose , read the period T of one rotation.

The period is 300 ms
The max rpm is 200 rpm.

Speed $= \frac{60}{0.3}$

RESULTS :

Hall Sensor

1) In relation to the speed, the amp is independent.
2) In relation to the speed, the signal shape the entire range independently
3) An accurate measure of the speed here in freq inductive sensor.
1) The freq & amp depends on the speed.
2) The value of the induced voltage depends on the spacing between the sensor & gear wheel, as well as the speed.

CONCLUSION :

Hence, we have successfully performed this practical for hall sensor, inductive sensor.

## Assessment Parameters (To be filled by Instructor)

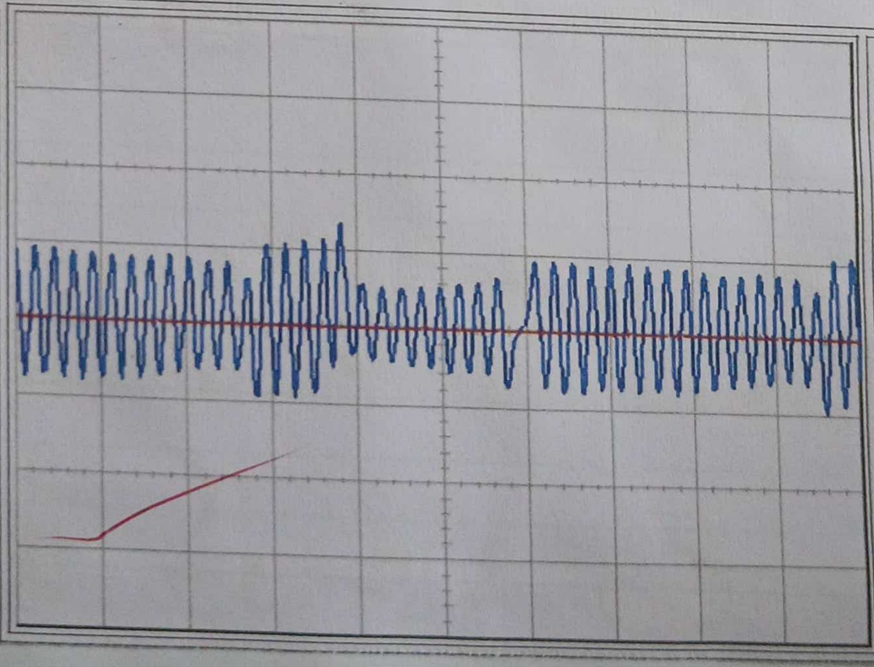
1. Successful completion of Practical ( Y/N)
2. Time taken ( hours / minutes ) : 2 Hr.

**3. List other Parameters & Outcomes :**

| Sr. No. | Parameter | Outcome (Achieved / Not Acheived) |
|---|---|---|
| 1) | Hall effect & Hall sensor working. | |
| 2) | Waveform observation is construction. | 5 |
| 3) | Inductive sensor working. | |
| 4) | Applications of sensor. | |
| | | |

Remarks : 5

INDUCTIVE SENSOR – 50% RPM



Time base: 50 ms / DIV

**Channel A:**

Amplitude factor: 200 mV / DIV

Coupling: ○ AC ◉ DC

**Channel B:**

Amplitude factor: ______ V / DIV

Coupling: ○ AC ○ DC

Total marks 10 out of 10.

Sign of Instructor

Date : 23/10

# PRACTICAL NO: 5

Date : 27/10/24

TITLE : Study and analyze CAN-BUS protocol (Low speed 125 Kbps).

AIM / OBJECTIVE: To understand Study and analyze CAN Bus protocol (Low speed 125 Kbps).

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

LN Interface
LN
Connecting cables
LN labsoft software.

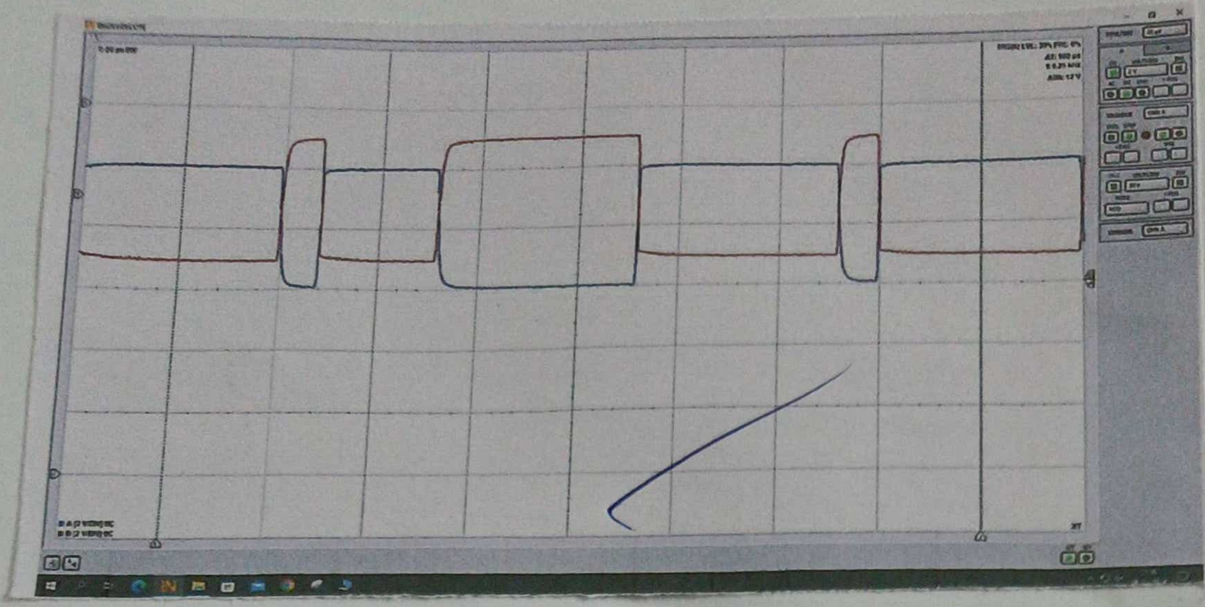
CONCEPT / THEORY OF EXPERIMENT:

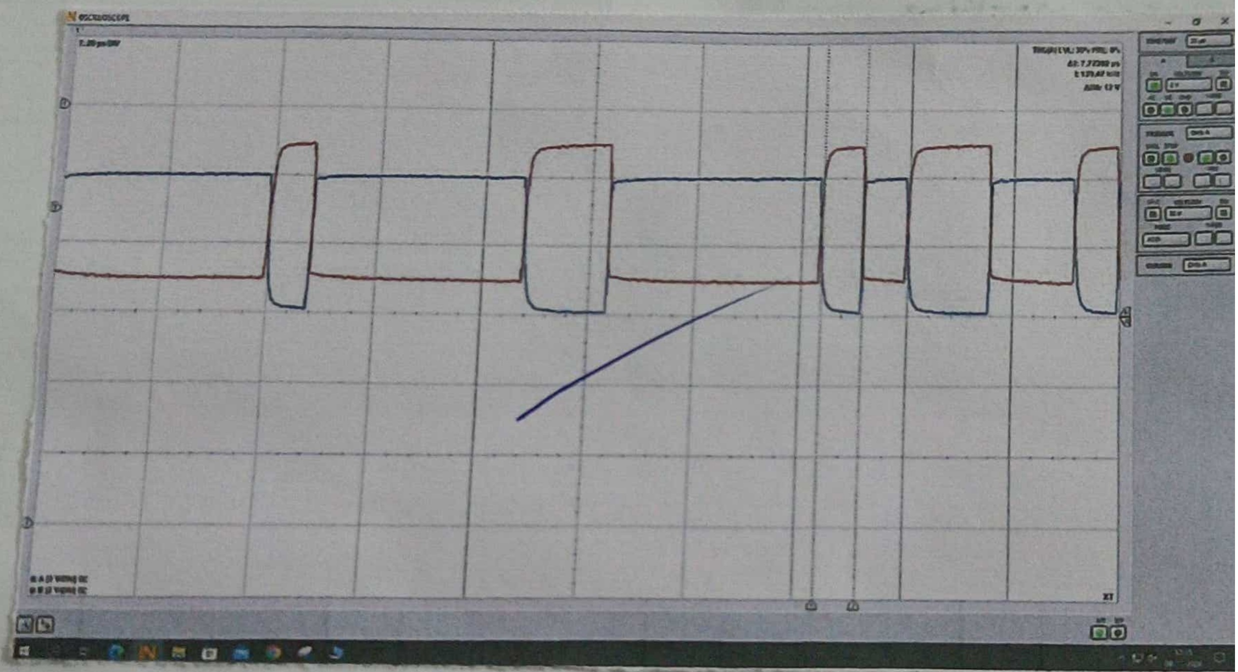
CAN is controller Area Network. CAN can be implemented either by High-Speed bus or Low-speed bus CAN Protocol uses bus topology which is a linear topology in which all CAN nooks are linked to a main line via start stubs. The 2 bus lines used in CAN bus protocol are the CAN-H and ~~CAN-L which~~ are CAN-High and CAN-Low respectively in directing ~~the~~ Voltage levels on the bus lines.

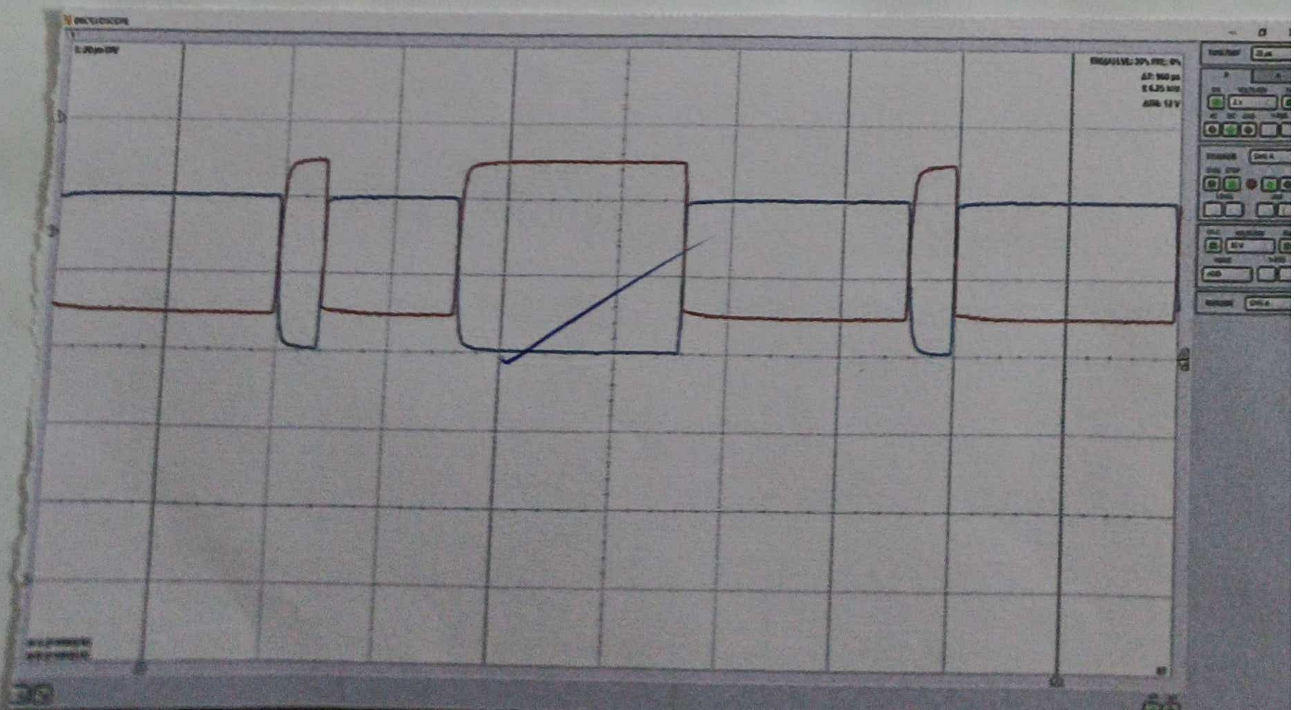
PROCEDURE :

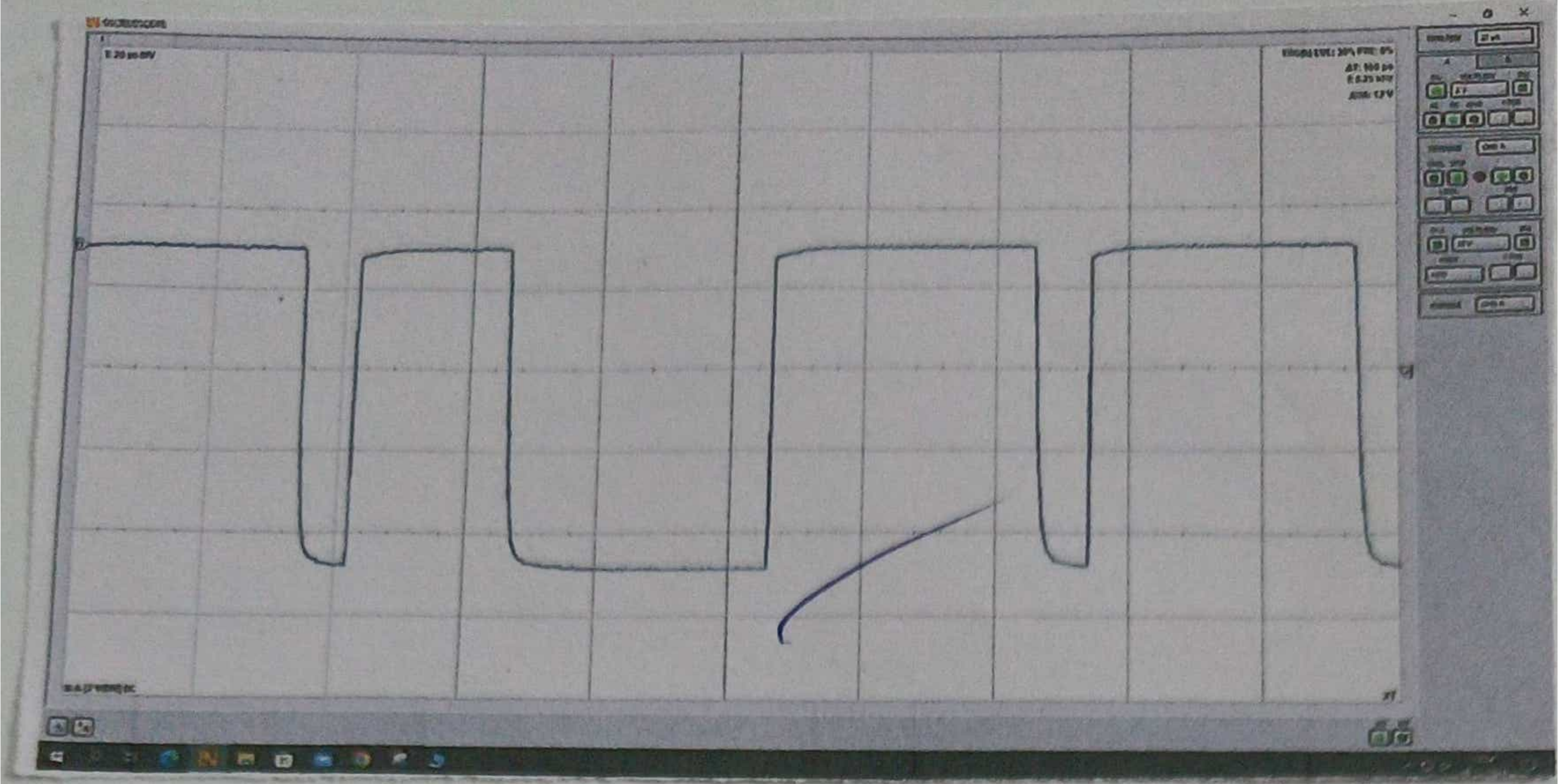
1) Open LN labsoft software.
2) Open self diagnosis on bus system course.
3) Follow the instructions given on the course and complete the experiment.

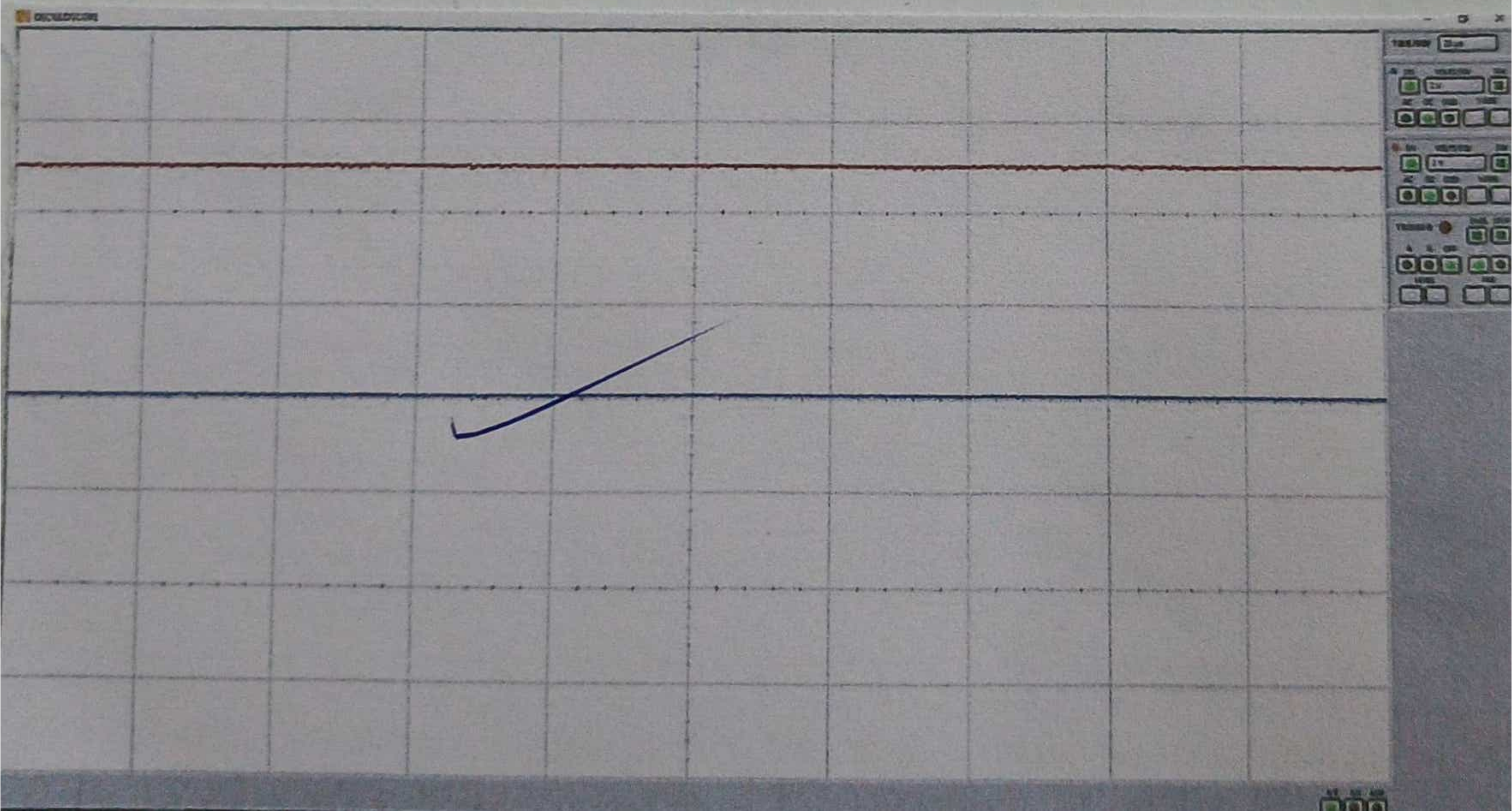
Theory:- The colour scheme for the CAN BUS Protocol of wires is not standerized and changes/varies from manufactores to manifuctures; when the bus is idle, its two mos are at different voltage levels. Low-speed CAN is considered under class ~~of~~ B networks. The maximum bit rate (baud rate) (bits/sec) is 125 Kbps. In a modern top range car has over 1000 dectical and electronics components. If the electrical wiring in a modern top-range car is laid end-to-end it goes upto several kilometers. The brakes types and











OBSERVATIONS

network primarily contribute to the 30 m braking distance project. Navigation Parking aid, ACC (Adaptive Cruise Control) applications involves off board networking. As cable harness would be too thick because of the number of wires in them plugs only have a limited number of pins and requirements of too many cables; conventional cabling is no longer adequite in vehicles is the no. of data lines is enormusly reduced most bus links are capable of auto-diagnosis and complex control functions are possible.

OBSERVATIONS :-

1) When a device is cut off from the bus wires, all the actuators connected to it remain in their present state.

2) Two CAN bus segments arise. There are completely independent of one another and each of them remains functional.

3) When the segments are reconnected the CAN bus responds as it way was doing before the interruption.

ii) Voltage levels on low-speed CAN:-

1) The voltage level on CAN-H is approximately 0 V.

2) The voltage level on CAN-L is approximately 5 V.

iii) Voltage levels:-

a) The recessive voltage level on CAN-H is 0V.

b) The recessive voltage level on CAN-L is 5V.

c) The dominant voltage level on CAN-H is 4 V.

d) The dominant voltage level on CAN-L is 1 V.

CALCULATIONS :

e) The CAN-H and CAN-L are out of phase.

iv) Differential Voltages :-

1) In the recessive signal state, the voltage differential between CAN-H and CAN-l is 5V.

2) In the dominant signal state the voltage differential between CAN-H and CAN-L is 3V.

3) The maximum voltage range is 8 Vpp

4) The differential voltage is calculated from the differntials by adding them together.

5) Bit durations and transmission rates (low speed):

1) The bit duration on bus corresponds to 8 µs.

2) The transmission rate on the bus corresponds to 125 kbits/s

RESULTS :

We have analyzed the working of low-speed CAN BUS Protocol along with its voltage levels, differential voltages, bit durations & transmission rates. Also we observed the output if the CAN Bus lines are interrupted.

CONCLUSION :

Hence, we have understood analyzed and studied the working of CAN BUS Protocol (Low speed 125 Kbps).

# PRACTICAL NO: 6

Date : 4/11/24

TITLE : Study and analyze CAN BUS Protocol (High Speed 1Mbps).

AIM / OBJECTIVE: To understand study & analyze CAN BUS Protocol (High speed 1Mbps).

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

LN Interface.
LN
Connecting wires.
LN labsoft software.

CONCEPT / THEORY OF EXPERIMENT:

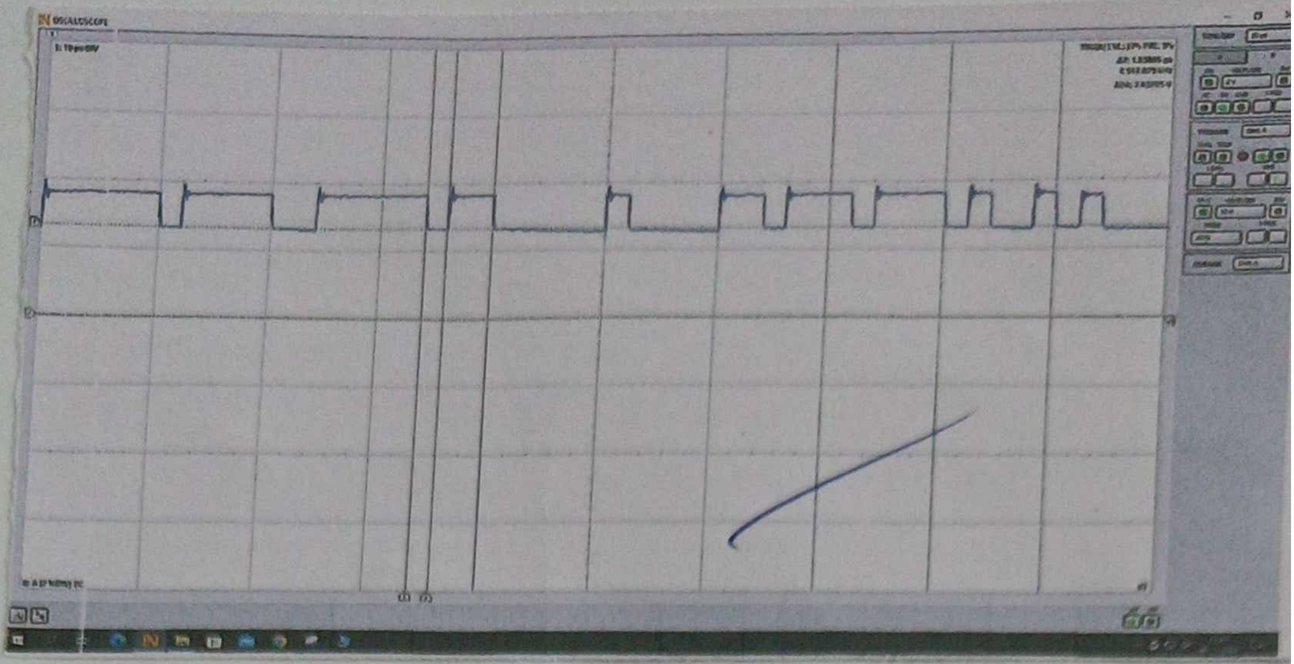
The CAN bus is composed of the following components:

1) Bus lines:- Two wires wound together as twisted pair.
2) Two terminators (for high speed CAN): 2 120 Ω resistors used at each end of high speed CAN BUS.
3) Transceiver: Component responsible of communication.
4) CAN Controller: Component that ensures that communication rules for bus are observed.
5) Microcontroller:- Valuates message received from CAN Controller.

PROCEDURE :

1) Open Labsoft software.
2) Open self Diagnosis on bus system course.
3) Follow the instructions & complete the experiments.

Theory :- 1 segment is called a field. Seven fields make up one message frame. The CAN Bus uses the bit-stuffing technique. The various parts of a data frame are :- ① Start field : one dominant bit. ② Arbitration field :- Identifier & control bit (RTR) (Remote Transmission Request). ③ Control field :- Has a 4 bit Data length Code (DLC).
④ Data field :- Consist of main data bits. ⑤ Cylic Redundany Check (CRC) ⑥ Acknowledgment field. ACK bits. ⑦ End of frame ⑧ Inter-frame space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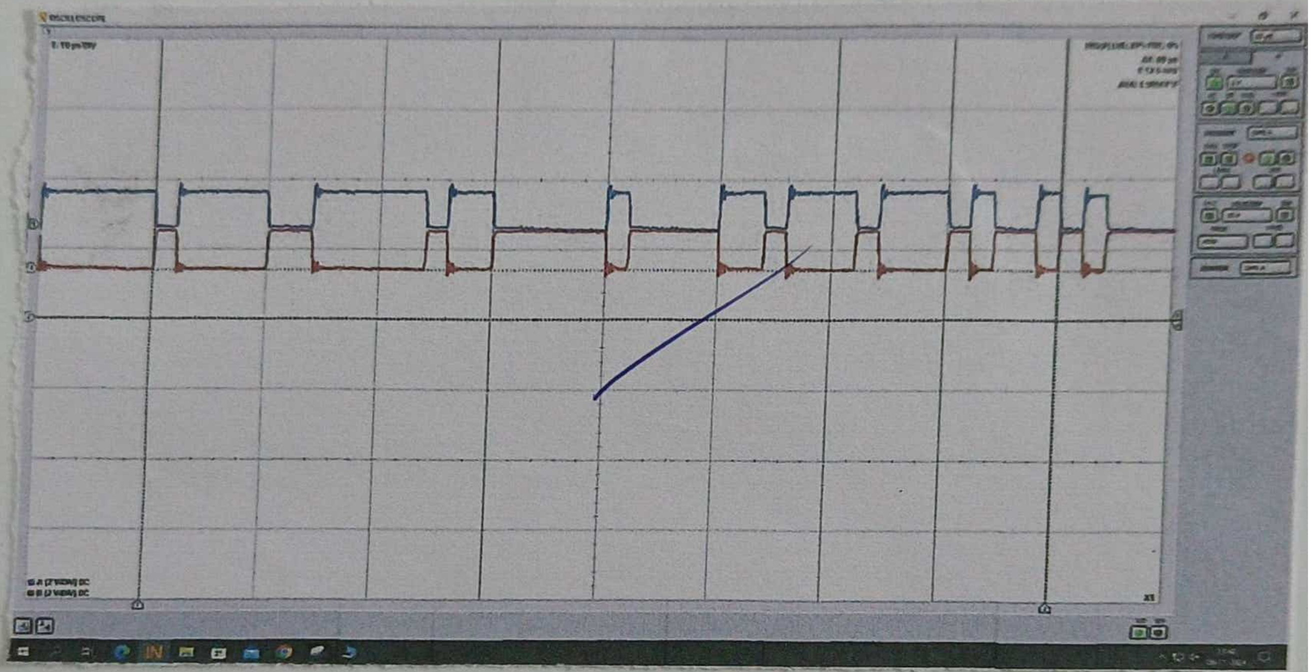
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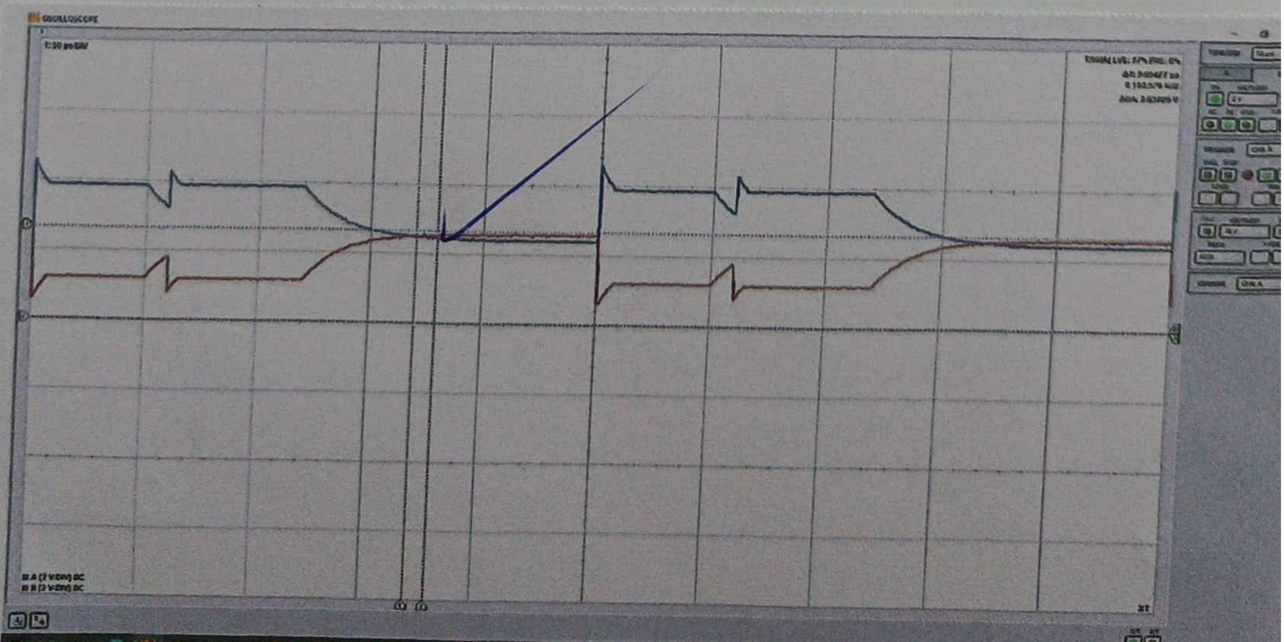
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OBSERVATIONS

The standard format of identifier is 11 bits (2048) long. The extended format of identifier is 29 bits (536870912). The standard format is CAN 2.0A and extended format as (AN 2.0B).

OBSERVATIONS:-

1) Data formats:- The standard data format is used on the CAN bus on the training system.

2) Interpreting Bus messages:-
① The length of the data bytes is specified in the DLC.
② The data byte is represented in hexadecimal on the CAN monitor.
③ A data byte can assume values of 0 to 255.

3) Voltage levels on high-speed CAN:-

1) The reccessive voltage level on CAN-H is 2.6V

2) The recessive voltage level on CAN-L is 2.5V.

3) The dominant voltage level on CAN-H is 3.5V.

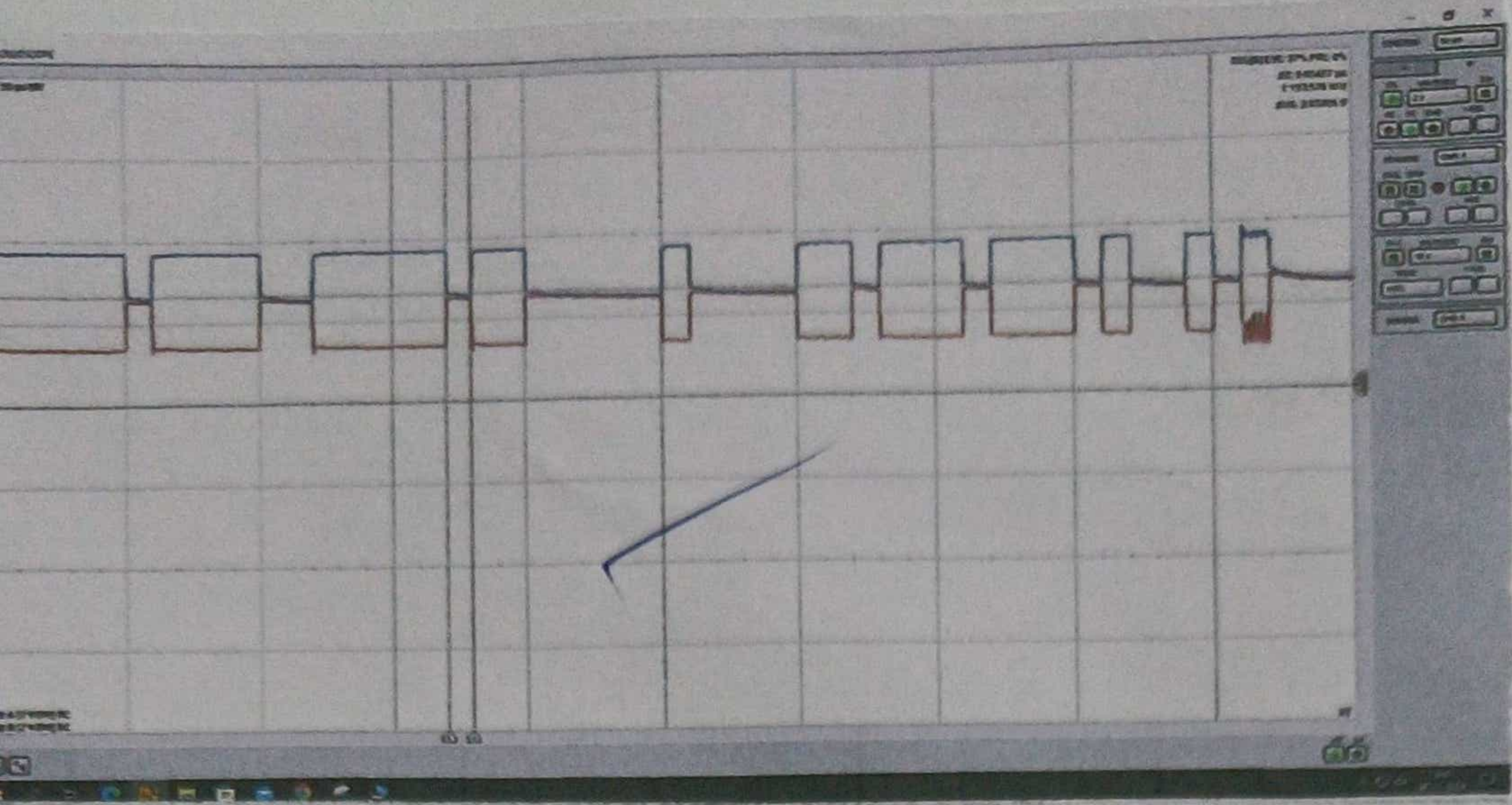
4) The dominant voltage level on CAN-L is 1.5V.

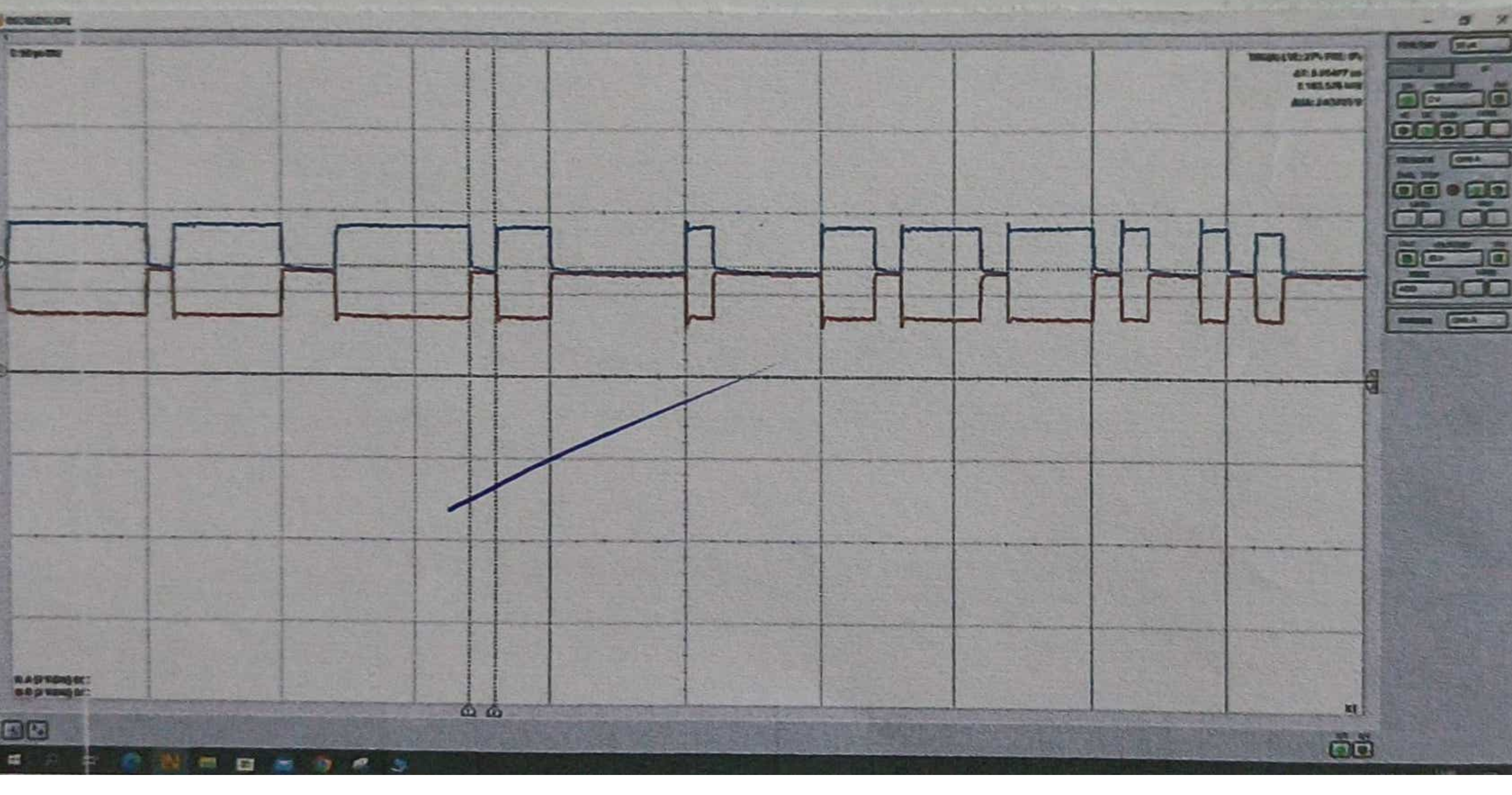
5) The CAN-H & CAN-L levels are out of phase.

4) Bit duration and transmission rates (High-speed):-

1) The bit duration on a high speed CAN bus is 2 us

2) The transmission rate on High-speed CAN bus is 500kbits/psec.





CALCULATIONS :

5) Terminating Resistors:-

1) The CAN bus is relatively insensitive to the removal of a terminator in low-speed mode.

2) The CAN bus is non-Functional, in low speed mode, when a terminator is removed.

3) The signal is less good when a terminator is removed in High speed mode.

4) The bus stops working when both terminators in high speed mode.

RESULTS :

We have analyzed the working of High-speed CAN BUS protocol, the data formats on CAN BUS Protocol; interrepted bus messages, the voltage levels on high-speed CAN, the bit duration and transmission rates (to in high-speed CAN & the usage of terimating resistors in high speed CAN BUS protocol.

CONCLUSION :

Hence, we have studied analyzed & understood the working of CAN BUS protocol (High Speed 1 Mbps).

**Assessment Parameters (To be filled by Instructor)**

1. Successful completion of Practical ( Y/N)
2. Time taken ( hours / minutes ) : 2 Hr.

**3. List other Parameters & Outcomes :**

| Sr. No. | Parameter | Outcome (Achieved / Not Acheived) |
|---|---|---|
| 1) | Understand the working of CAN BUS protocol (High speed 1 Mbps). | |
| 2) | Study & analyze the working of CAN BUS Protocol (High speed 1 Mbps). | |

~~Remarks~~ : THEORY

In a CAN BUS Protocol a zero '0' has precendence over one "1". As '0' to s precedence over '1', '0' is termed dominant and '1' is timed recessive. This behaviour is termed 'negative logic'.

Bit state '0' : dominant
Bit state '1' : recessive

The individual bits are represented by means of two voltage levels on each line of the 2-wire CAN BUS.

Total marks 09 out of 10.

1/8/11
Sign of Instructor
Date :

# PRACTICAL NO: 8

Date : 4/4/24

TITLE : Study & analysis of LIN BUS Protocol.

AIM / OBJECTIVE: To understand study & analyze the working of LIN BUS Protocol.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

LN Interface
LN Cords
Connecting wires
LN labsoft software.

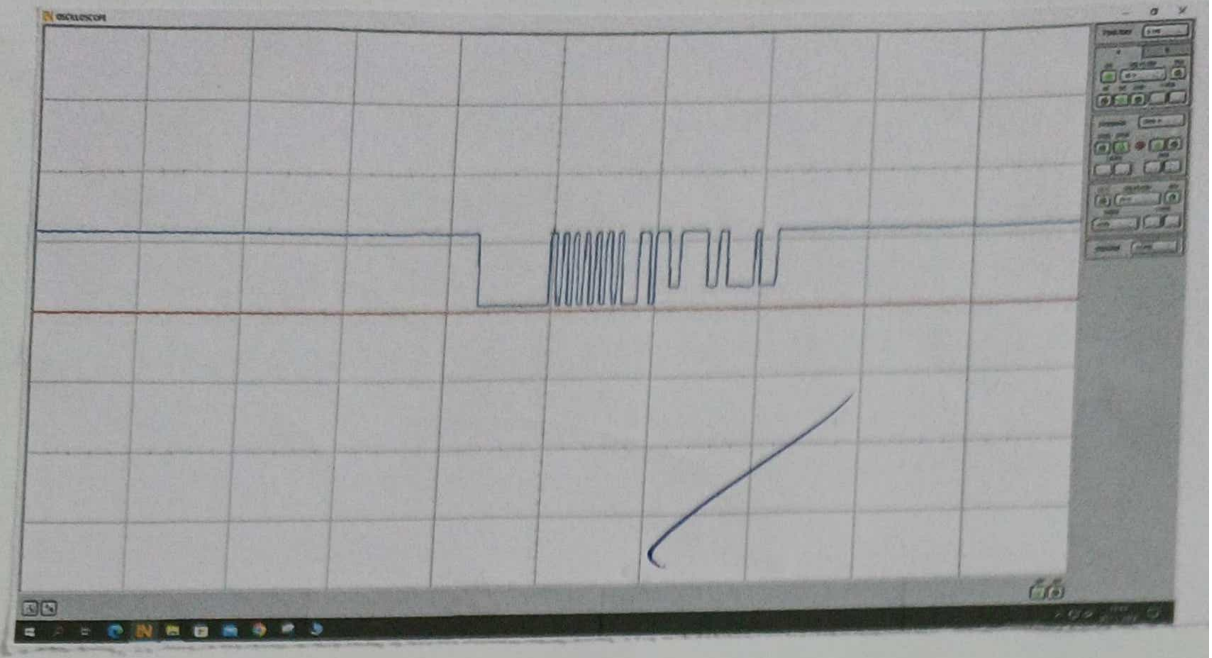
CONCEPT / THEORY OF EXPERIMENT:

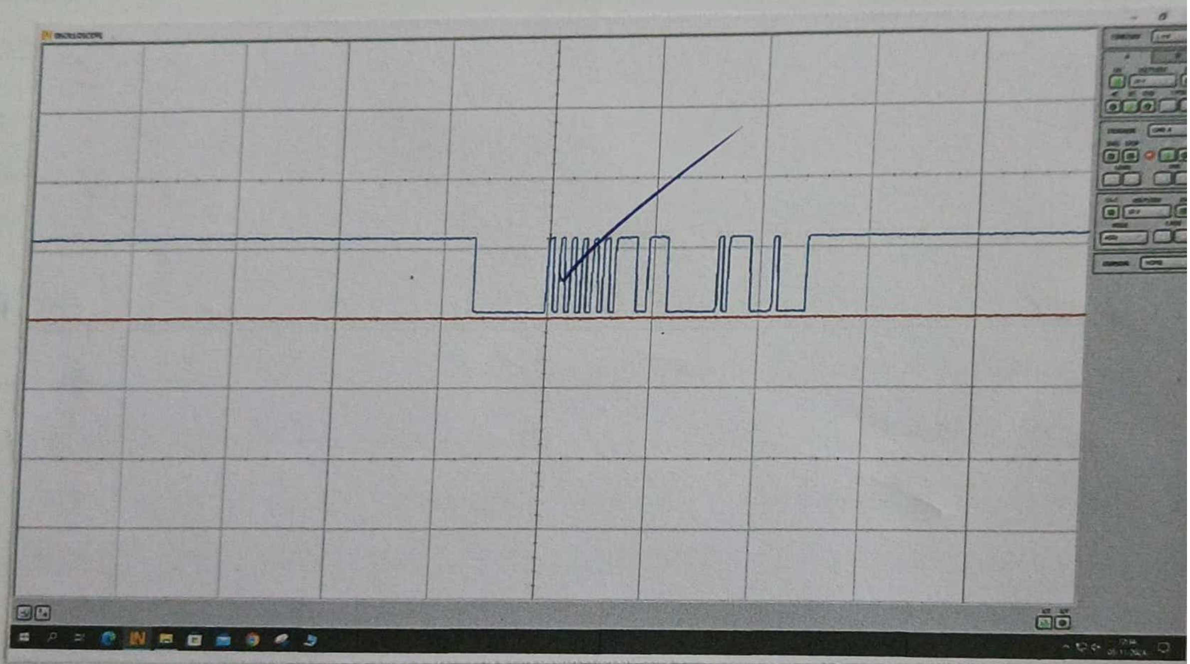
The LIN ~~Bus~~ (Local Interconnect Network) Bus network control units for comfort elements which are specitially or functionally located near each other. The performance of LIN bus does ~~not~~ reach that of CAN or FlexRay, but it is adequate for many applications in the comfort area where low transmission capacity suffices and demands for transmission security are low.

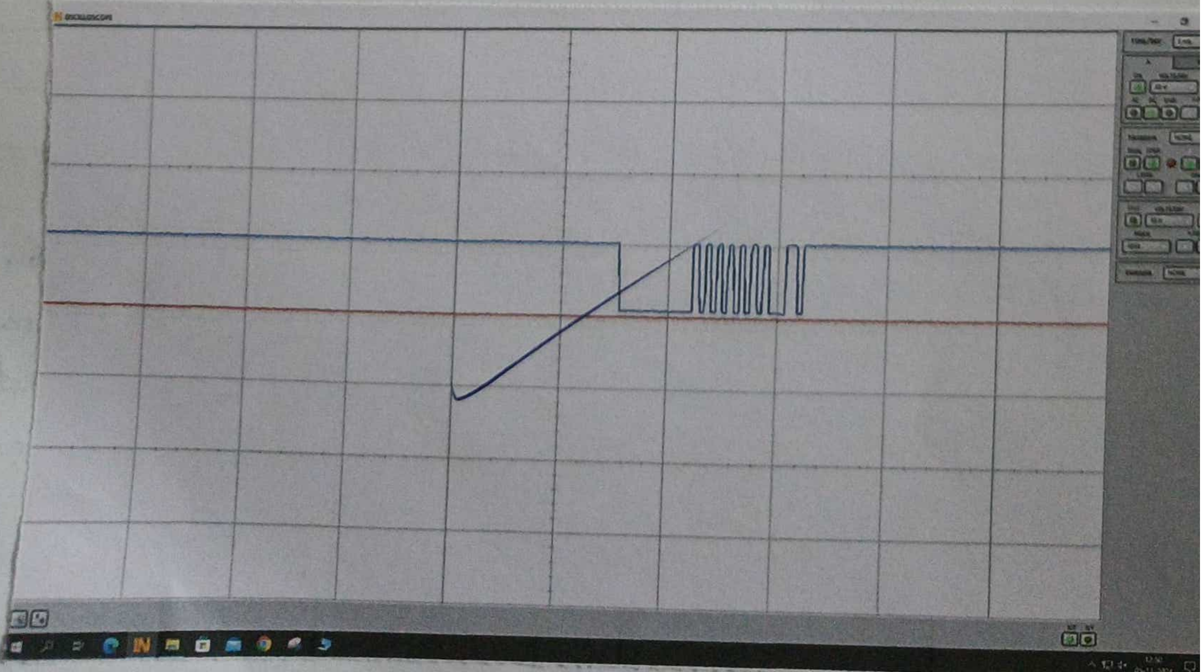
PROCEDURE :

1) Open LN software.
2) Open LIN protocol course.
3) Follow the instructions given & complete the course.

Theory :- The LIN BUS is a voltage cooked bus system & the information is transferred from the master control unit to the slave control unit by means of voltage signals. The data is transmitted in bits via an unshielded single conductor cable. Characteristic for the LIN BUS is a combination of one Master control unit and upto 16 slave control units.







OBSERVATIONS

1) Communication of Control Units:-

a) Task 1 :- The LIN BUS is operated at approx. 11.5V.

b) Task 2 :- ① The High level voltage approx. 11.5V.
② The low level voltage approx. 1V.

2) Topology of the LIN BUS:-

1) The structure of the setup circuit corresponds with linear or bus structure.

2) A linear or bus structure & active star structure topologies are used for LIN BUS.

3) Linear or Bus structure & passive star structure topologies can be crafted with the enclosed circuit boards.

4) The arrangement of the control units has no influence on the function.

3) Voltage tolerances:-

a) Experiment 1 :-

① The low level (dominant level 1) changes with a resistance in the LIN data cable.

2) From approx 5V the communication is no longer possible.

b) Experiment 2:-

① The High level (recessive level) is pulled down.

2) Blow approx. 6V the communication is no longer possible.

c) Experiment 3:-

1) OF identifier has the window winder.

2) Window winder switch not pressed → 00 of
Raise window → 02 of
Railazer window → 01 OF

Identifiers:- Mirror heating → 05
Central locking → 2D
Flasher switch → 09
Mirror adjustment → 27.

CALCULATIONS :

Theory :- Different masters can be networked together via can bus. The structure of a message & Frame is defined by the LIN message format: The message consists of the message header and the message response.

The message header has :-

Synchronisation break → at least 13 dominant bits.

Synchornisation delimiter → at least 1 recessive bit.

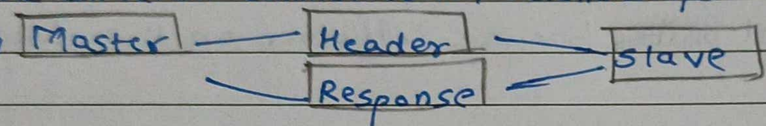
Synchronisation field → bit sequence always 0101010101 i.e. 10 Bit

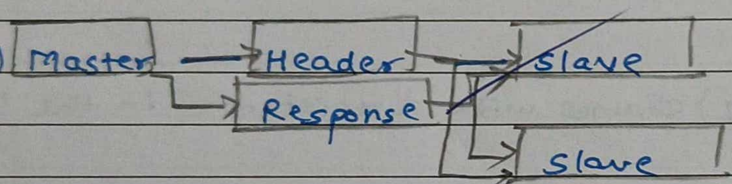
Identifier field → 8 bits

Message contrends :- max 8 data fields each 10 bits i.e. more 80 bits.

Message length :- 120 Bits approx.

The different Communication relationships :-

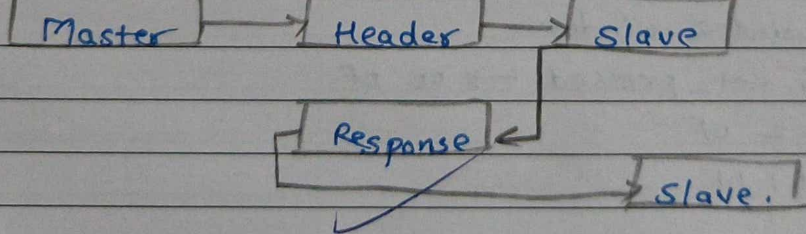
1) 


2) 


RESULTS :

We have analyzed the LIN BUS Protocol, its topology, it's voltage tolerances and also used the LIN BUS Monitor & sent data from the PC to the system.

Theory :-




CONCLUSION :

Hence we have studied & analyzed & understood the working of LIN BUS Protocol.

# PRACTICAL NO: 9

Date : 27/10/24

TITLE : Study and analyze the PWM concept and its automative application.

AIM / OBJECTIVE: The objective of this activity is to carry the pulse width of a signal by using a pulse width modulation and analyze how PWM is depended ~~op~~ upon the frequency.

APPARATUS / TOOLS / EQUIPMENT / RESOURCES USED:

Experiment card - fet amplifier and indicator LED's
Interface module SO4203-2A
multi 31s Digital multimeter
Unitrain measurement accessories, shorts and cable connections.

CONCEPT / THEORY OF EXPERIMENT:

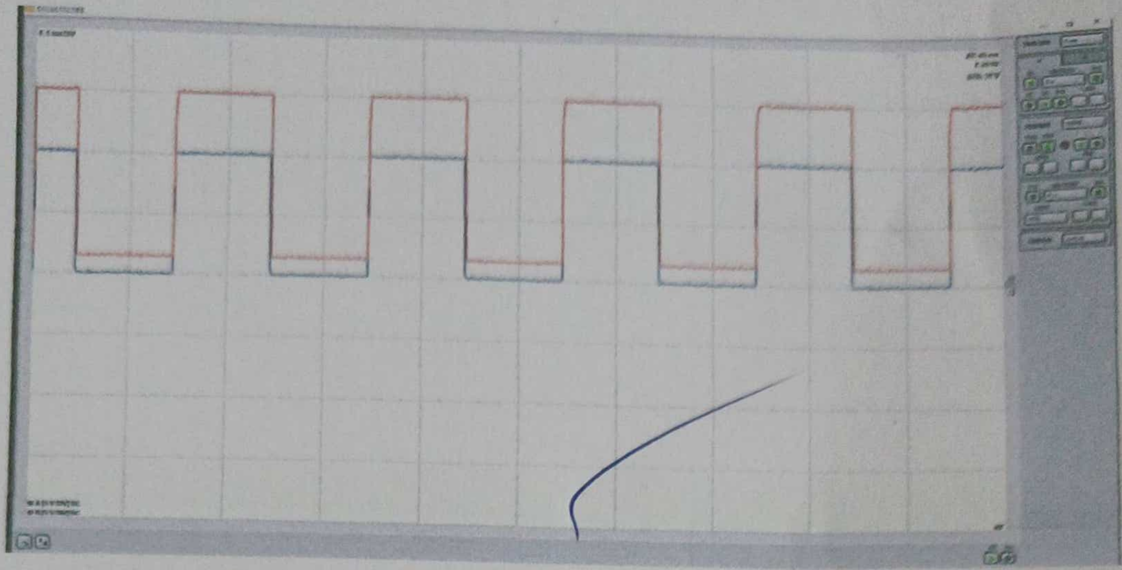
Pulse width modulation reduces the arrange power delivered by an electrical signal by converting the signal into discrete parts. In PWM technique, this signal energy is distributed through series of pulses rather than a continuously (analogue) ~~===~~ varying signal.

PROCEDURE :

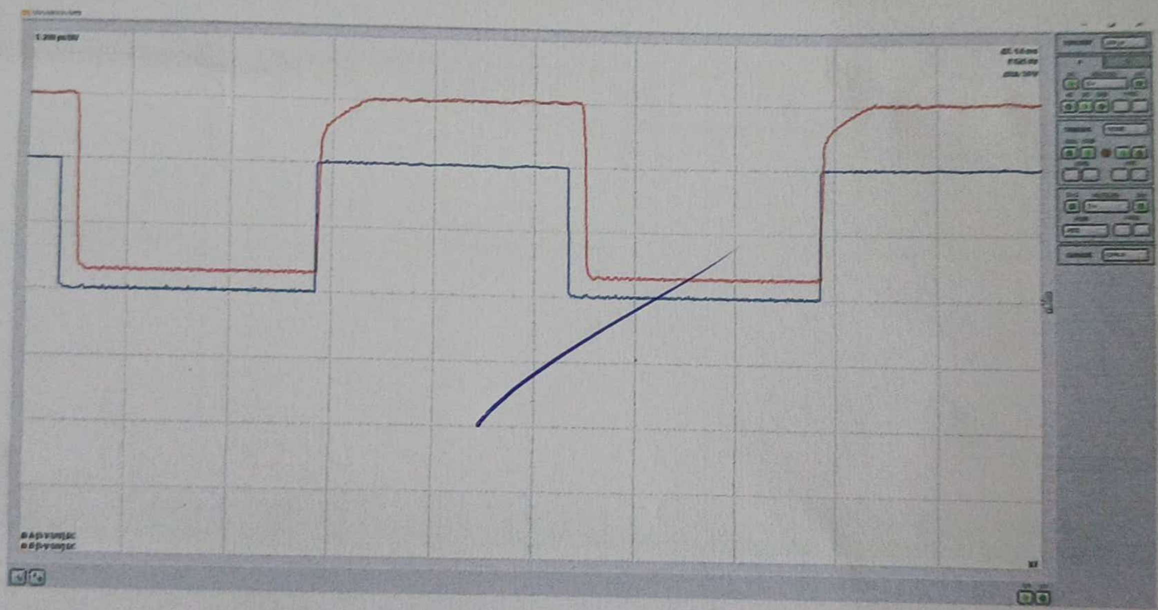
For Pulse Width Varying Signal:-

1) Generate a PWM signal with the amplitude of 100%, pulse width of 50% and a frequency of 100 Hz.
2) Turn on the power switch by means of its POWER switch.
3) Turn signal on oscillascope at a time duration of Trigger.
4) Copy the oscillation.
5) Complete oscillascope in evaluation section.
6) Close oscillascope.
7) Set both voltmeter A and B.
8) Set both voltmeter to 20V and AV measurting mode.
9) Copy the values measured by the voltmeter to the evalution section.

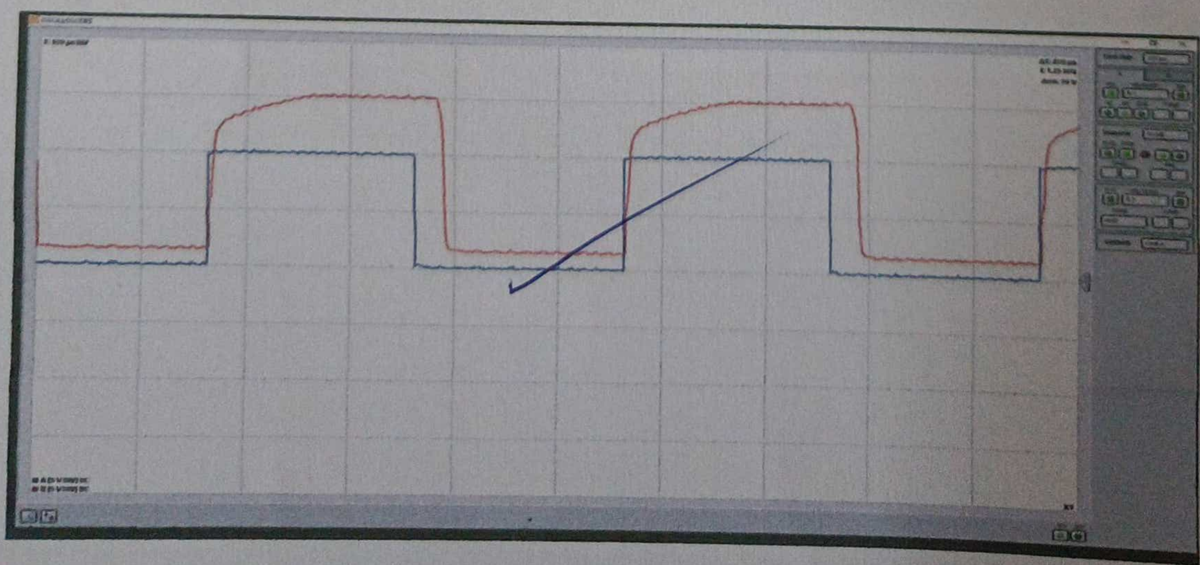
Practical-9



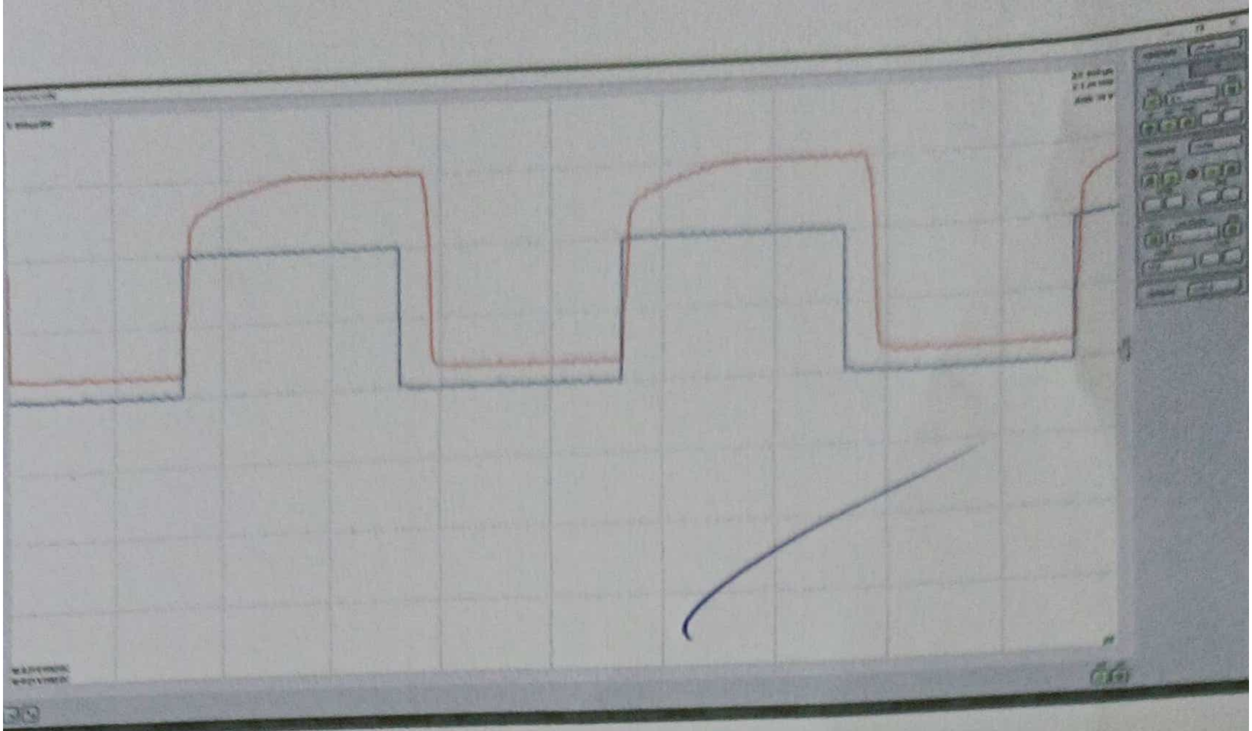
Ampiltude Measurement 100%



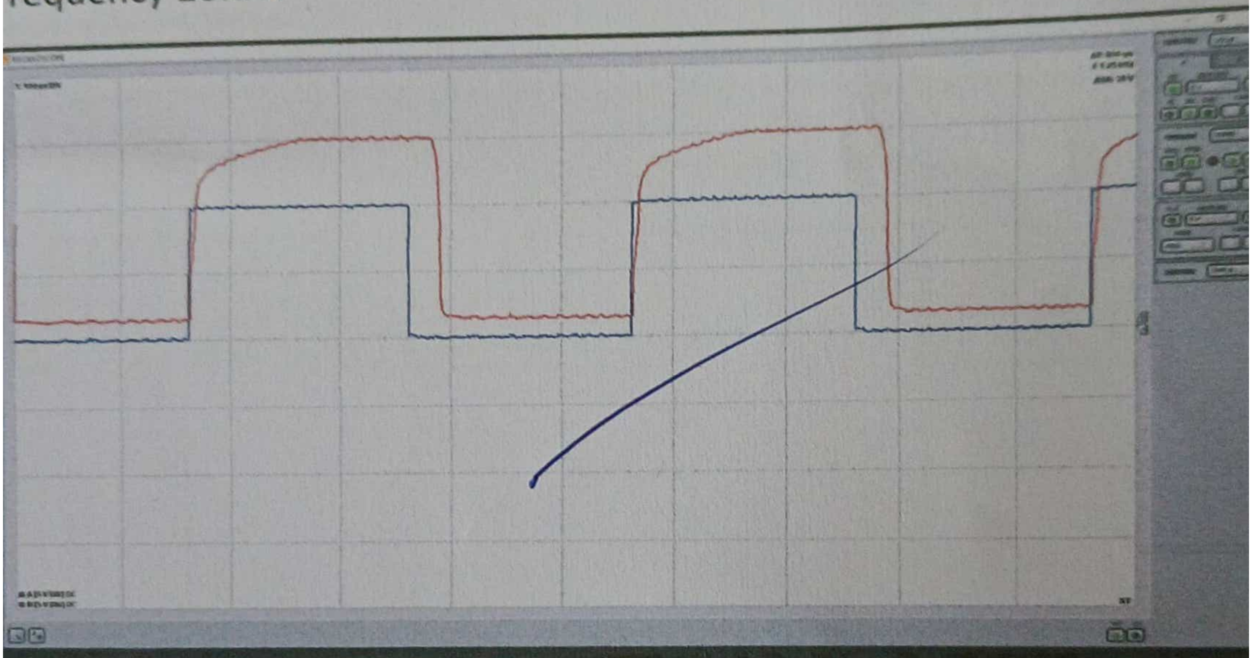
Frequency 1KHz



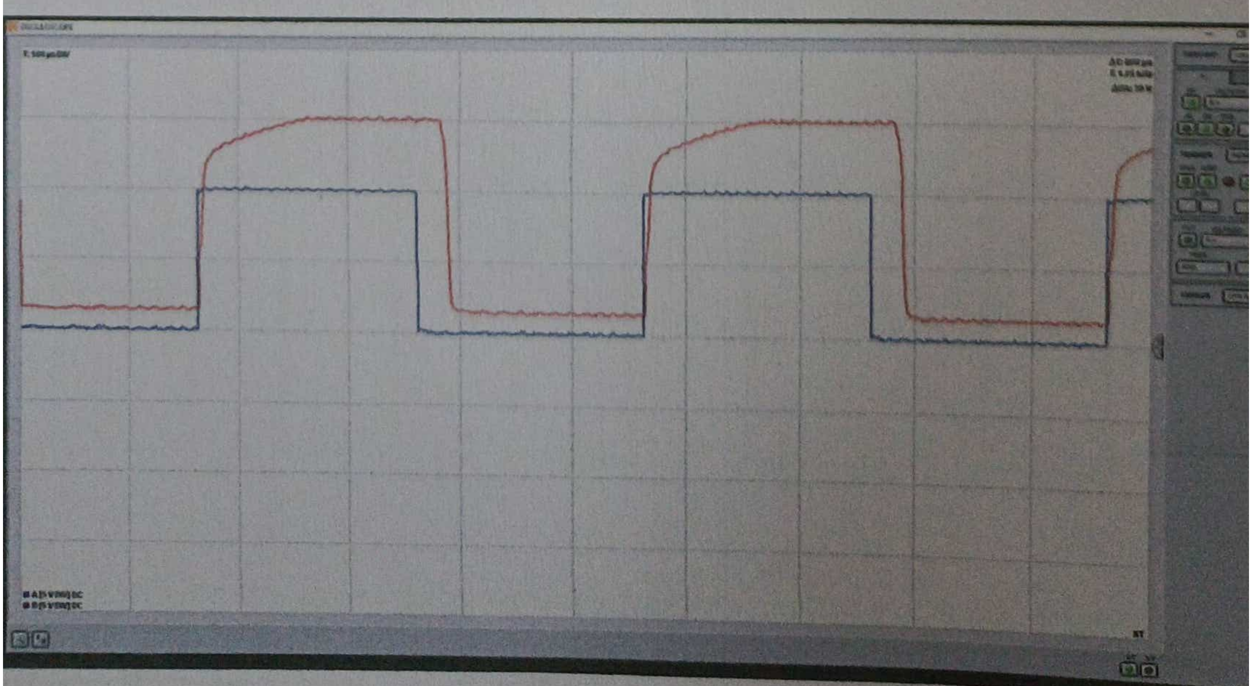
Frequency 2.5KHz

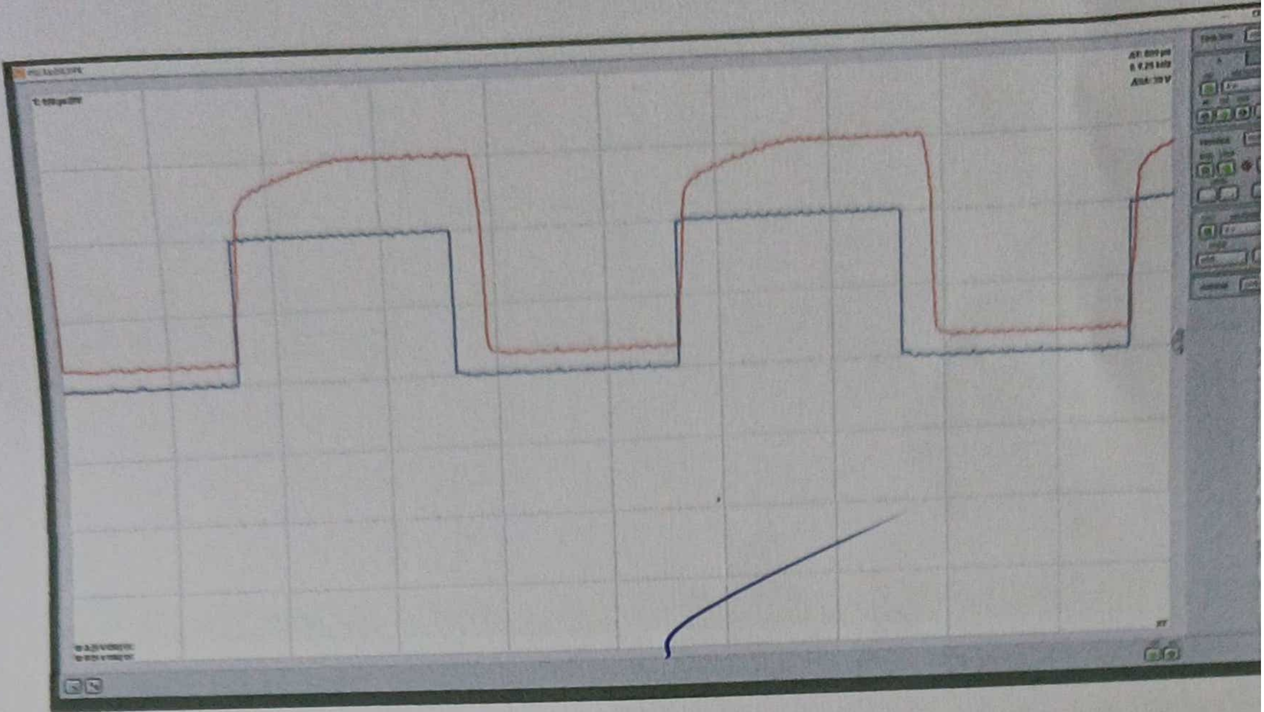


Frequency 10KHz

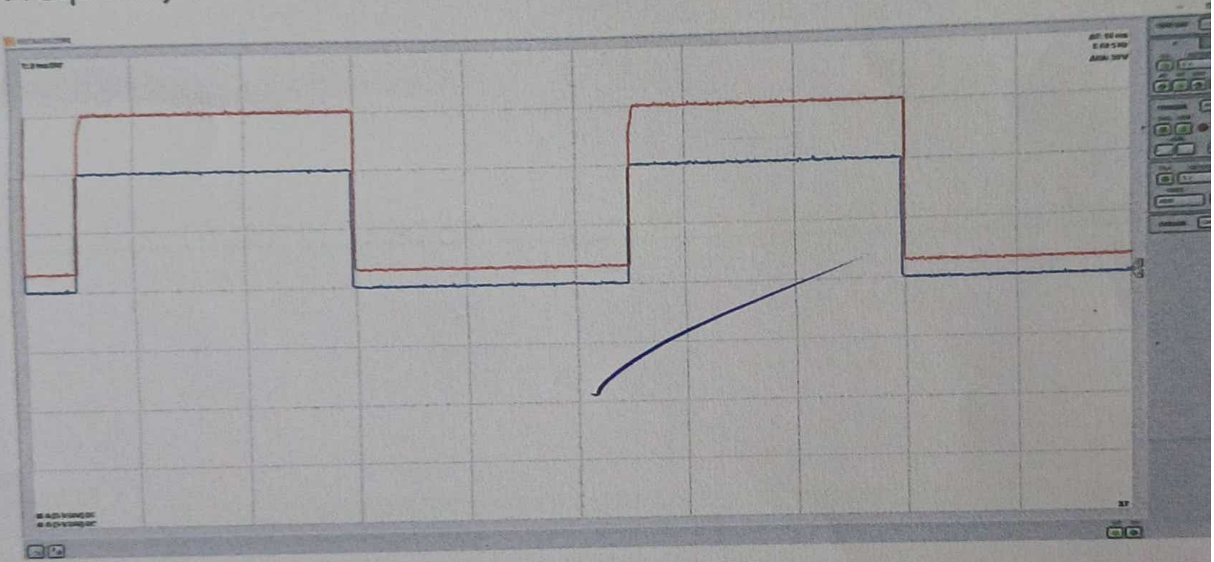


Frequency 25KHz

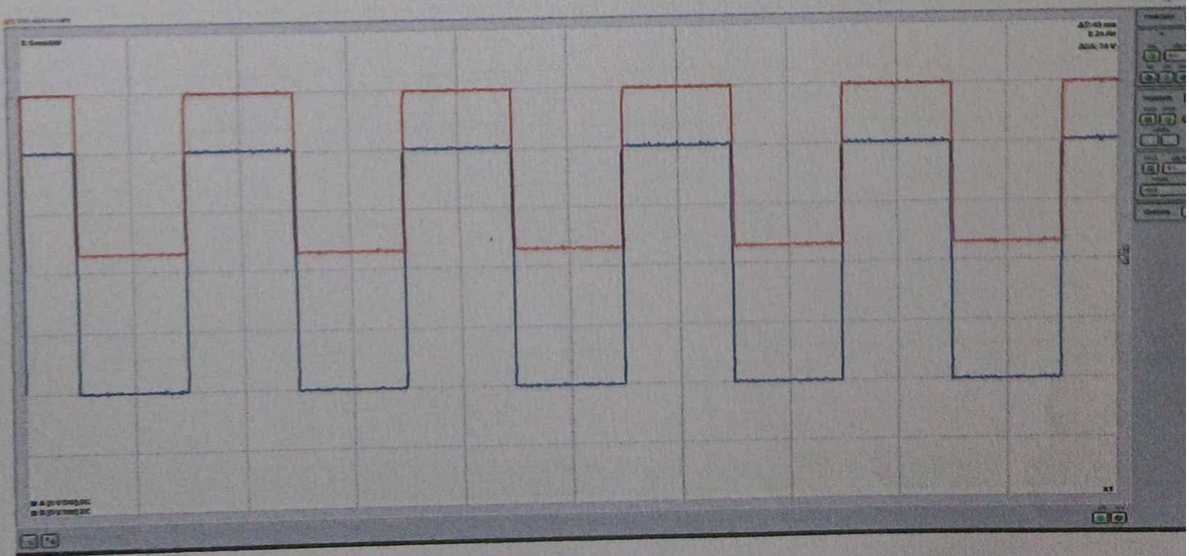


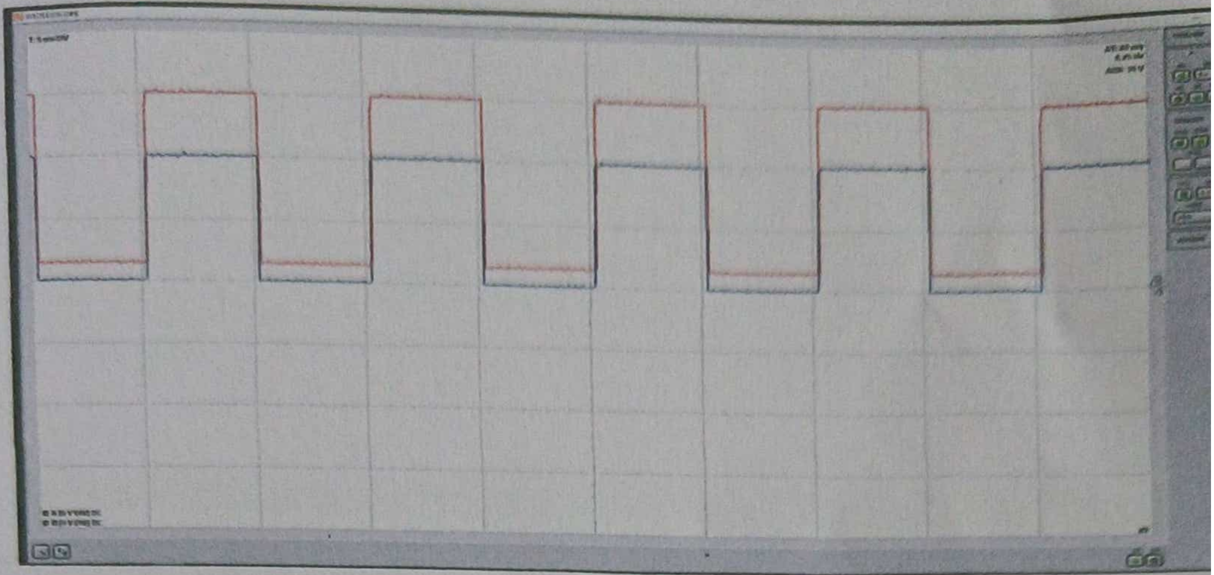


Frequency 50KHz

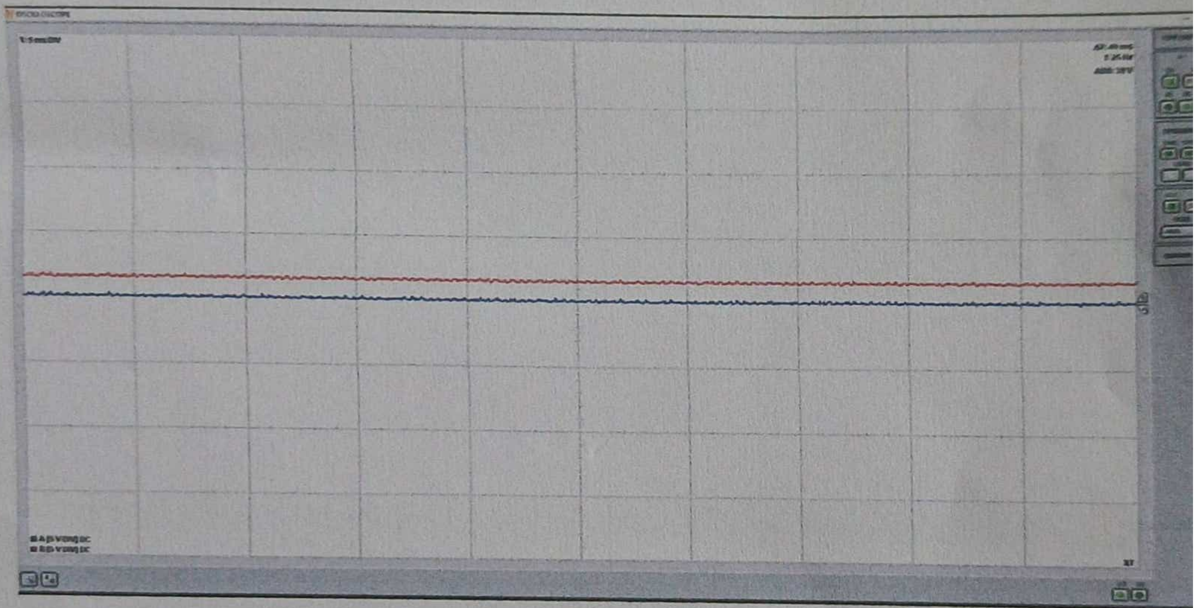


Frequency 100Hz

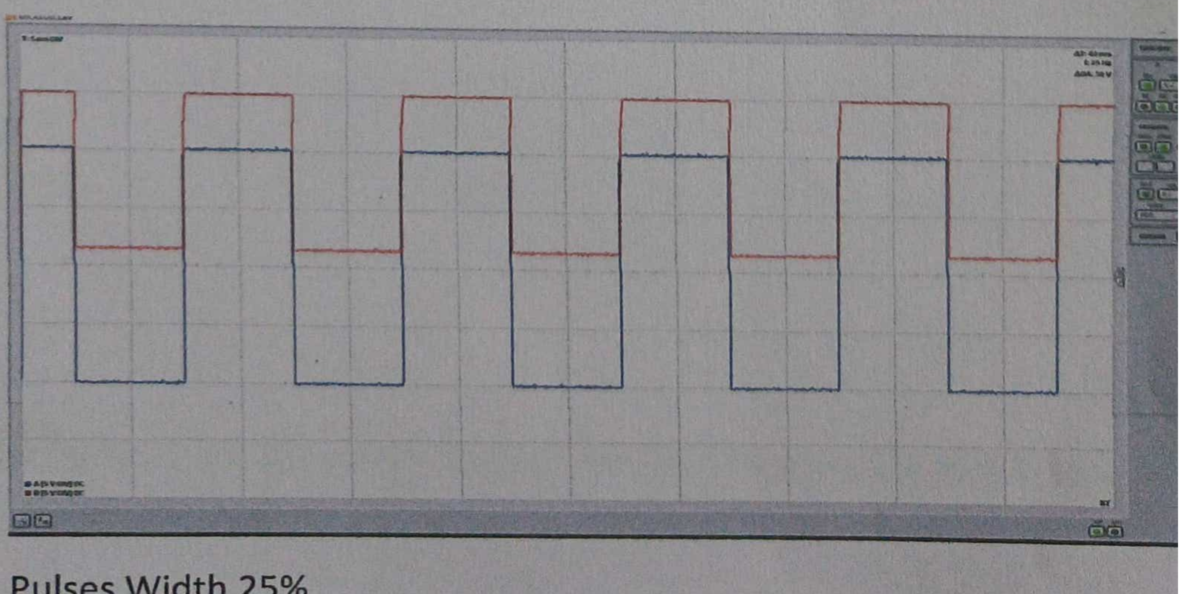




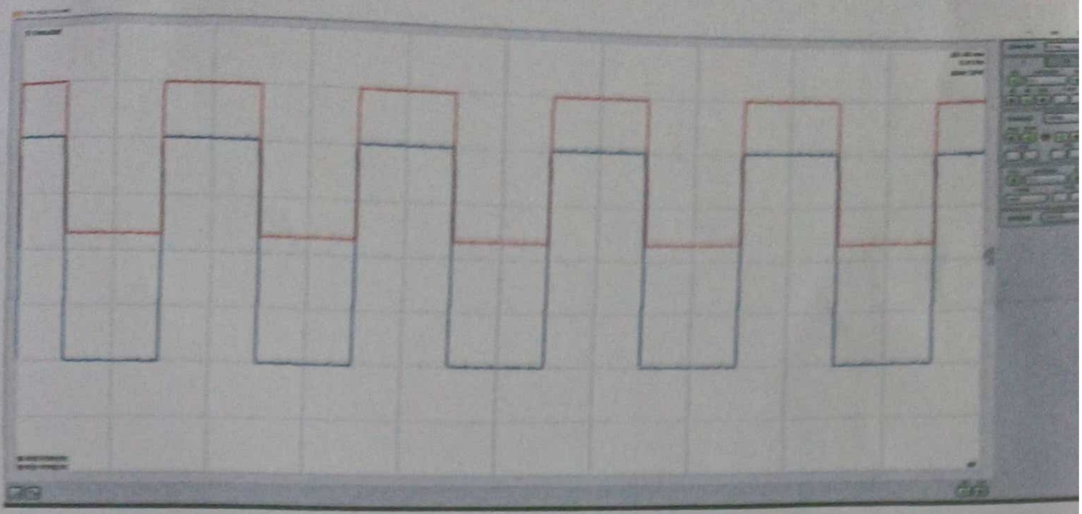
Polarity Uni-Polar



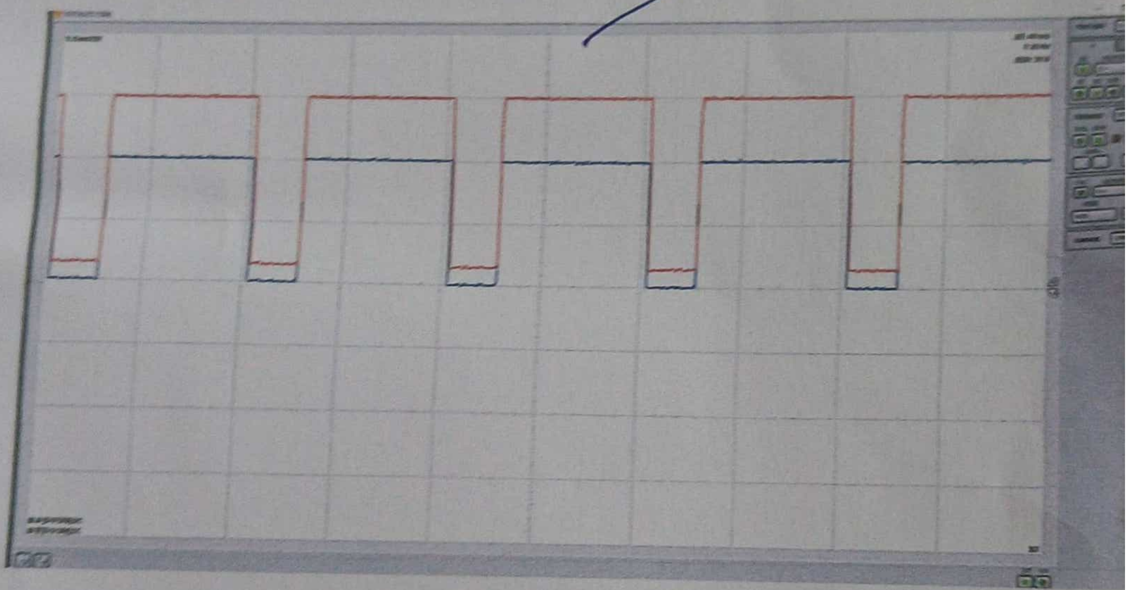
Pulse Width 0%



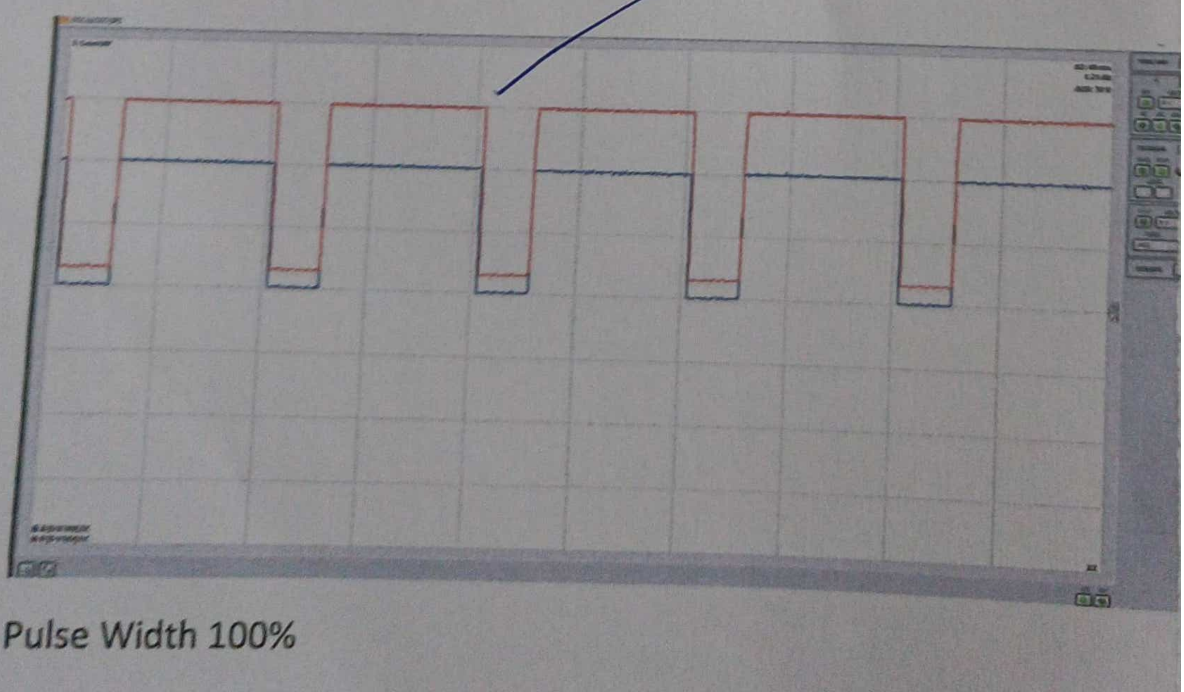
Pulses Width 25%



Pulse Width 50%



Pulse Width 75%



Pulse Width 100%

OBSERVATIONS

For Frequency Dependencacy :-

1) Generate a PWM signal with an amplitude of 100%. ,pulse width of 50%. and Frequency of 50Hz.

2) Turn on the measurement by means of its POWER switch.

3) Trace the signal on oscilloscope.

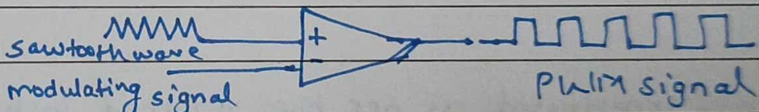
• Formulas required to determine PWM parameters :-

$$\% \text{ Duty Cycle} = \frac{T_{ON}}{T_{ON} + T_{OFF}}$$

$$\text{Frequency} = \frac{1}{T} \quad \text{where } T = T_{ON} + T_{OFF}$$

• Working of Pulse Width Modulation :-

→ A PWM signal is generated using a comparator. The modulating signal forms one part of the input to the comparator, while the ~~signal forms one part~~ ~~of~~ non-sinusoidal forms the other part of input. The comparator compares two signals and generates a PWM signal as it's output waveform.




• Advantages of PWM :-

PWM technique prevents, overheating of an LED while maintaining it's brightness. PWM technique provides a high input power factor.

Application of PWM :-

1) PWM is used in telecommunication for encoding purpose.

2) PWM technique is used in Audio/Vedio amplification.

3) PWM helps in voltage regulation and is therefore use to control the speed of a motor.

CALCULATIONS :

RESULTS :

Performed experiment as per the ~~required~~ instrument.

CONCLUSION :

Average voltage increase with pulse width.
Average voltage indicated by the voltmeter is proportional to the pulse width.