I

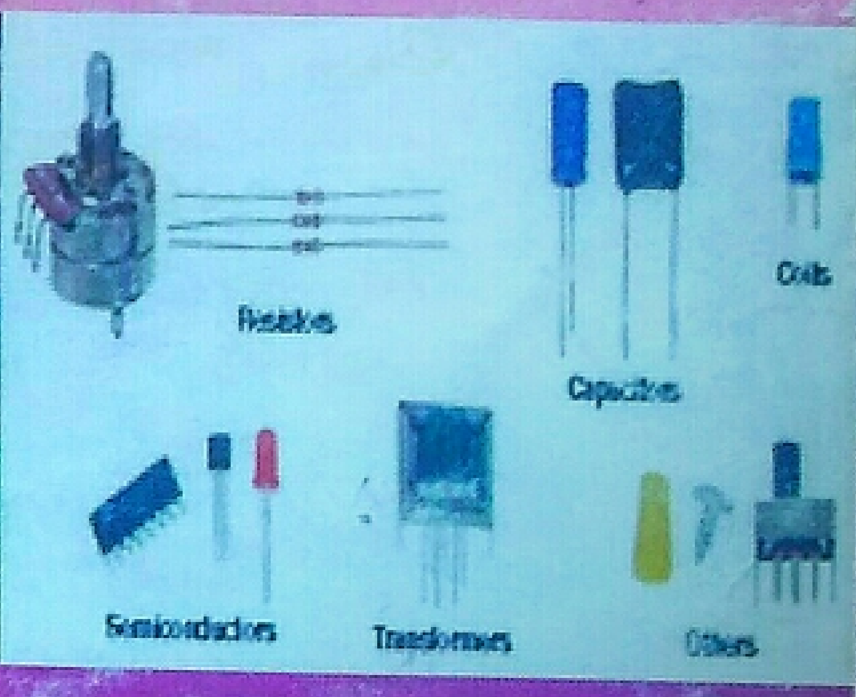
Name ____________________

Roll No. __________ Year 20 ______ 20 ______

Exam Seat No. ____________________

COMPUTER GROUP | SEMESTER - II | DIPLOMA IN ENGINEERING AND TECHNOLOGY

A LABORATORY MANUAL FOR BASIC ELECTRONICS (22225)



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI
(Autonomous) (ISO 9001 : 2015) (ISO / IEC 27001 : 2013)

Practical No.1: Measure Amplitude, Time Period and Frequency of Sine Wave and Square Wave Using CRO.

I Practical Significance

In industries, for manufacture and maintenance of Electronic circuits, measurement / testing are a prime requirement. The various parameters are to be tested with utmost accuracy and precision. For this purpose testing instruments like CRO are used. Through this experiment, student will be able to handle CRO and multimeter efficiently for measuring amplitude, time period and frequency of a given input

II Relevant Program Outcomes (POs)

PO1. Basic knowledge: An ability to apply knowledge of basic mathematics, science and engineering to solve engineering problems.

PO3.Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

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

PO10.Life-long learning: Engage in independent and life-long learning activities in the context of technological changes in the Computer Engineering field and allied industry.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use simple electronic circuits of computer system'***

I Record Measurements.

II Draw Waveform and calculate Amplitude and Time period.

IV Relevant Course Outcome(s)

This experiment is a prerequisite to achieve various course outcomes.

V Practical Outcome

To measure Amplitude, Time period and Frequency of Sine wave and Square wave using CRO.

- Identify the controls of CRO.
- Identify the controls of Signal generator
- Measure amplitude of sine wave and square wave given from signal generator
- Measure time period and frequency of sine wave and square wave given from signal generator.
- Make connections between the input source and measuring instrument.
- Adjust the various controls to observe the input signal and measure voltages and frequency.

VI Relevant Affective domain related Outcome(s)

i. Handleequipment carefully.

ii. Follow safety practices.

VIII PracticalCircuit diagram:

(a) Sample

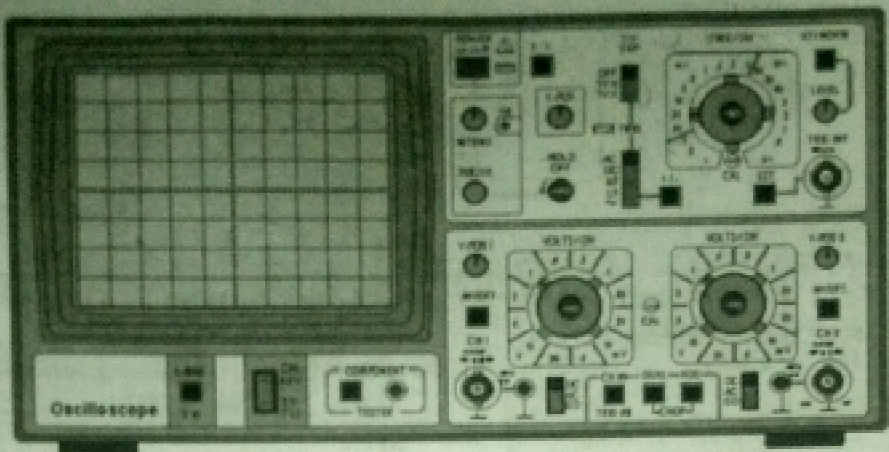


Figure 3: Front panel of CRO

Figure 4: Front panel of Signal Generator

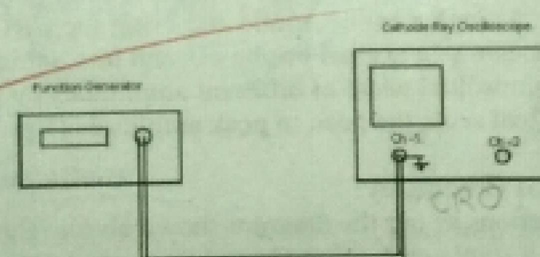
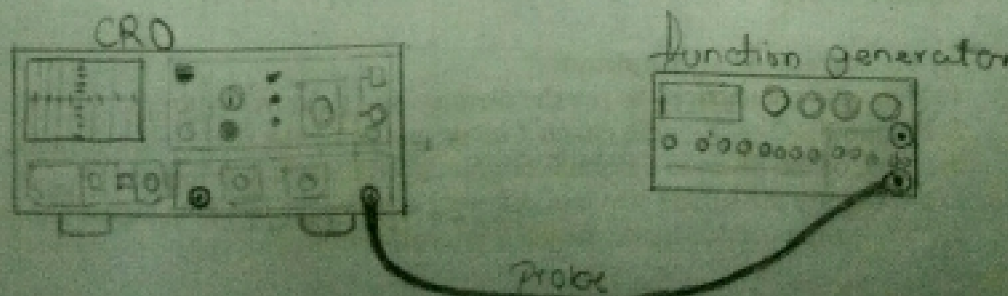
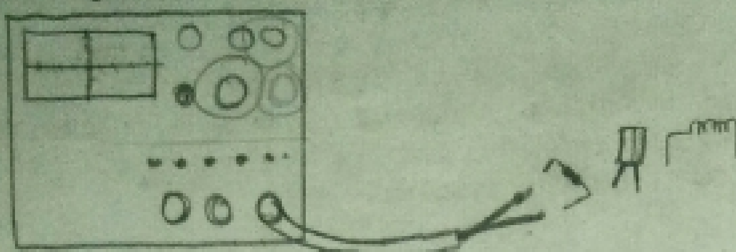


Figure 5: Connecting Function Generator to CRO

(b) Actual Circuit used in laboratory



(c)Actual Experimental set up used in laboratory



IX Resources required

Sr. No.	Name of Resource	Suggested Specification	Quantity
1.	CRO	0- 20MHz, dual trace, dual beam,	1 No.
2.	Signal Generator	0- 1 MHz	1 No.
3.	Connecting wires	Banana plugs	4 No.
4.	CRO Probes	Any	1No. each

X Precautions

1. An Oscilloscope should be handled gently to protect its fragile vacuum tube.
2. Never advance the Intensity control so far that an excessively bright spot appears. Bright spots imply burning of the screen. A sharp focused spot of high intensity (great brightness) should never be allowed to remain fixed in one position on the screen for any length of time. It may cause damage to the screen.

XI Procedure

Sine Wave

A) Measurement of Amplitude:

1. Make the connections as per the diagram shown above (fig 5).
2. Put the CRO on a single channel mode and bring the CRO into operation by adjusting the trace of the beam to a normal brightness and into a thin line.
3. Now apply the sinusoidal wave of different amplitudes by using signal generator
4. Note on the vertical scale the peak to peak amplitude (Vpp).

B) Measurement of Frequency:

1. Make the connections as per the diagram shown above (fig 5).
2. Put the CRO on a single channel mode and bring the CRO into operation by adjusting the trace of the beam to a normal brightness and into a thin line.
3. Now apply the sinusoidal wave of different frequencies by using signal generator
4. Note down the horizontal scale period (T) in second by observing difference between the two successive peaks of the waveform.

Square Wave:

A) Measurement of Amplitude:

1. Make the connections as per the diagram shown above (fig 5).
2. Put the CRO on a single channel mode and bring the CRO into operation by adjusting the trace of the beam to a normal brightness and into a thin line.
3. Now apply the square wave of different amplitudes by using signal generator
4. Note on the vertical scale the peak to peak amplitude (Vpp).

B) Measurement of Frequency

1. Make the connections as per the diagram shown above (Fig 5).
2. Put the CRO on a single channel mode and bring the CRO into operation by adjusting the trace of the beam to a normal brightness and into a thin line.
3. Now apply the square wave of different frequencies by using signal generator.
4. Note down the horizontal scale period (T) in second by observing difference between the positive transitions of two successive waveforms.

XII Resources Used

Sr. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	CRO		dual, trace,	1	
2.	Signal Generator		0-1 MHz	1	
3.	Connecting wires		Bana plugs	4	

XIII Actual Procedure Followed

1. We measured the waves like sin & square wave
2. Measured the amplitude of sin & square wave.
3. And also Measured the frequency of them.
4. By setting the apparatus as per the given figure.
5. By using CRO & sin generator. & also noted
6. their vertical, Volts, Horizontal, division & Time period

XIV Precautions followed

1. We handled CRO carefully & gently.
2. We not advanced the intensity control so far that an
3. excessively bright spot appear. We not allowed
4. the sharp focused spot of high intensity.

XV Observations and Calculations:

Function	Vertical Division (a)	Volts/div (b)	Amplitude (p-p) a x b	Horizontal division(c)	Time / div (d)	Time period (T) c x d	Frequency (1/T)
Sine	5	0.2	1	10×0.2	0.1	0.5×0.1	1KHz

Square	8	0.2	1.6	10	0.2	2	10kHz

XVI Results

Amplitude of sine wave is ....1.............. (any one)
Amplitude of square wave ....0.8.......... (any one)
Frequency of sine wave is ....1k..............(any one)
Frequency of square wave is ....10k.............(any one)

XVII Interpretation of results (Give meaning of the above obtained results)

By this practical we learnt the Amplitude of sin & square wave & finded their time period & frequency of bothe the waves.

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results).

Hence, from this practical we successfull learnt about measurment of sin & square wave & learnt about removing amplitude, Time period, frequency, of sine & square wave.

XIX Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

1. Determine the amplitude of the waveform from Vp-p calculated.
2. If time period of sine wave is 1*m*S, calculate the frequency.

[Space for answers]

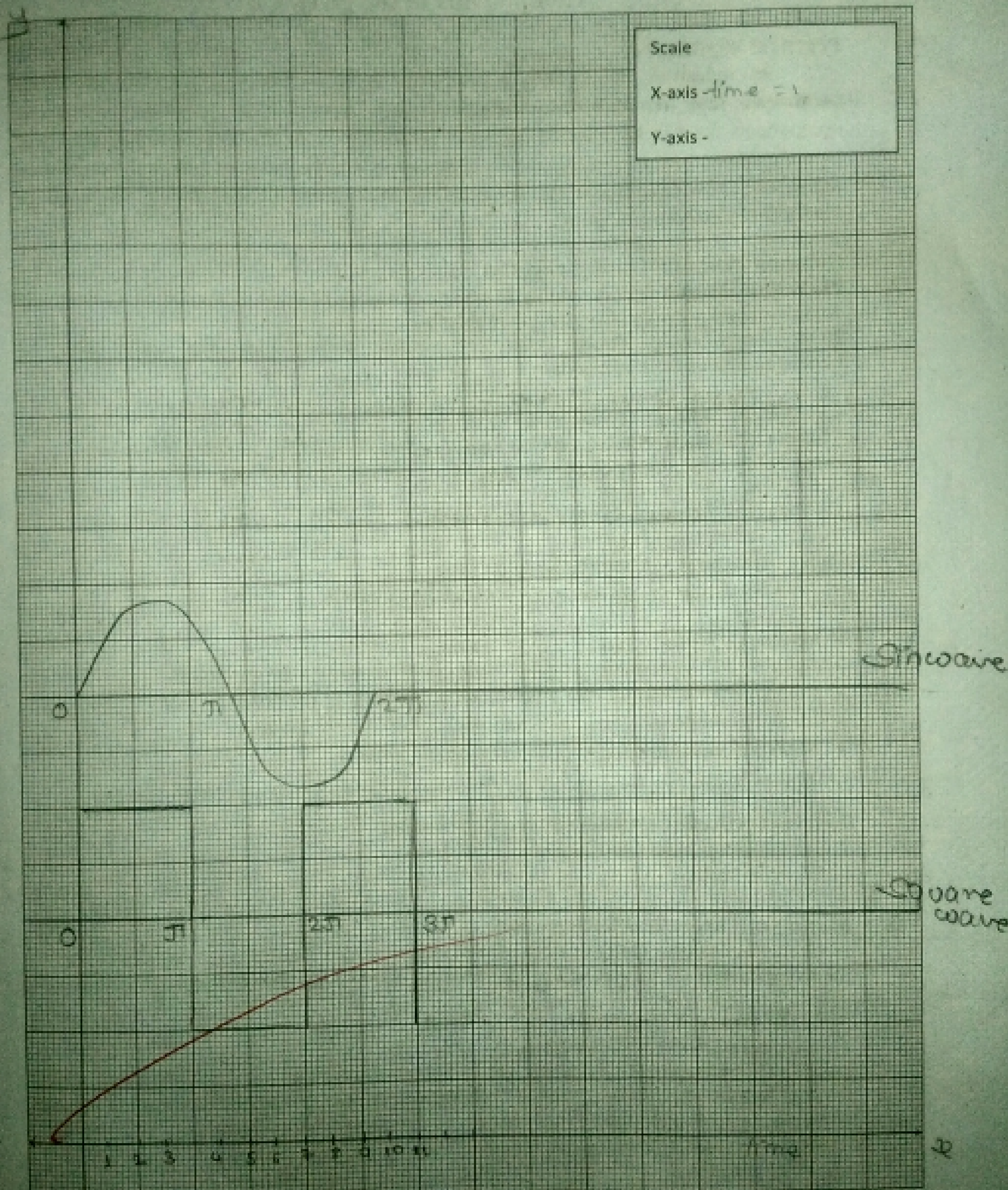
XIX

1 ⇒ V.P-P is Peak to peak voltage calcelator e.g VP-P = 2 x VP. peak amplitude & value (P) are same equal.

V.P-P :- The full voltage between positive & negative peaks of the waveform; that is, the sum of the magnitude of the positive & negative peaks.

② ⇒ frequency = 1sec / 1ms
= 1000 ms / 1 ms
= 1000 Hz
frequency will be 1 kHz

types of wave forms



Practical No.2: Identify Active and Passive Electronic Components in the given Circuit.

I Practical Significance

In industries, to build any hardware, it is necessary to identify electronic component, their terminals, values and packaging. Depending on application appropriate components need to be selected for better performance. In this experiment student will identify active and passive electronic components on the basis of physical verification and basic knowledge about the components. Multimeter /LCR-Q meter are used to verify the components value.

II Relevant Program Outcomes (POs)

PO1. Basic knowledge: An ability to apply knowledge of basic mathematics, science and engineering to solve the engineering problems.

PO4. Engineering Tools: Apply appropriate technologies and tools with an understanding of the limitations.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency '***Use simple electronic circuits of computer system***':

i. Identify electronic components.

ii. Calculate/ Measure value of component.

IV Relevant Course Outcome(s)

- Identify electronic components in electronic circuits.

V Practical Outcome

To identify active and passive Electronic components in a given circuit.

- Identify active and passive electronic components in the given circuit
- Identify component, terminals and packaging of a component.
- Measure/ Calculate the valuesof given components.

VI Relevant Affective domain related Outcome(s)

i. Handle components and instruments with care.

ii. Work in team.

VII Minimum Theoretical Background

Active components: Those devices or components which required external source for their operation is called Active Components. An active component may provide power gain to a circuit.

Example: Diodes & Transistors

Passive Components: Those devices or components which do not require external source for their operation are called Passive Components. A passive component does not provide any power gain to a circuit.

Example: Resistor, Capacitor and Inductor

VIII Practical Circuit diagram

(a) Sample

Figure 1: Passive Components and Active Components

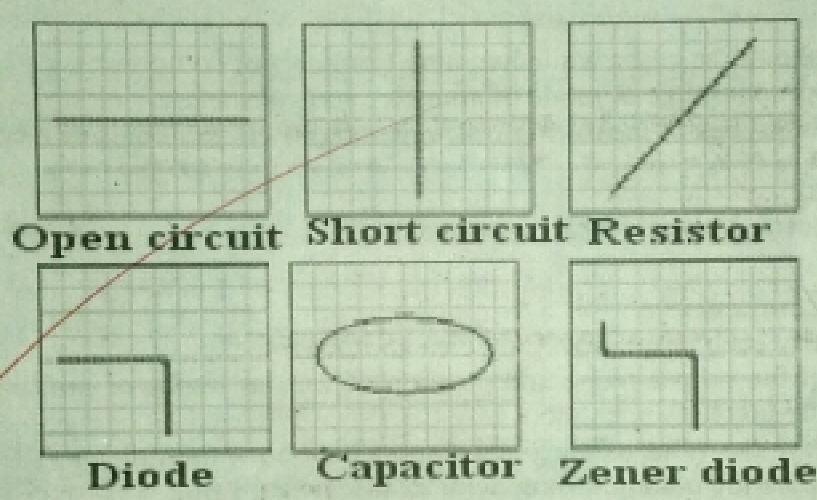


Figure 2: Testing components on CRO

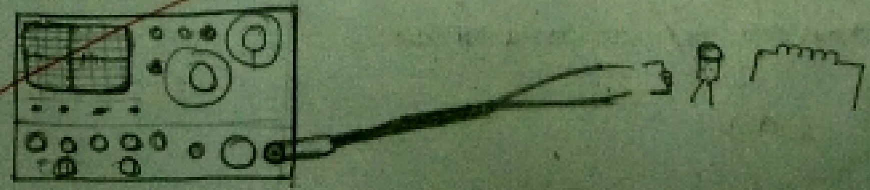
(b) ~~Actual Circuit used in laboratory~~ Classification of Components:-

{Components}

Active
Diode FET MosFET

Passive
Resistor Capacitor Inductor

(c) Actual Experimental Set up used in laboratory: NA



XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	CRO		Beam CRO	1	
2.	Diode		zener diode, PN Diode	1	
3.	Resistor		fixed resistor	1	
4.	Capacitor		fixed capacitor	1	

XIII Actual Procedure Followed

1. Select the electronic component available in the laboratory.
2. Than we identify the each component & their user.
3. After it we used to measure their therotical valu
4. After it we also used to measure their value from
5. With the help of CRO screen in the ~~form~~ of
6. the graphs. In this way we successfully classified the components

XIV Precautions

1. Took care while handeling terminal of components.
2. Seleted proper range & mode of ammeter and voltmeter. Connect tightly probes to terminals of components.

XV Observations and Calculations(use blank sheet provided if space not sufficient)

a. Identify component by its physical observation.
b. Label its terminals.

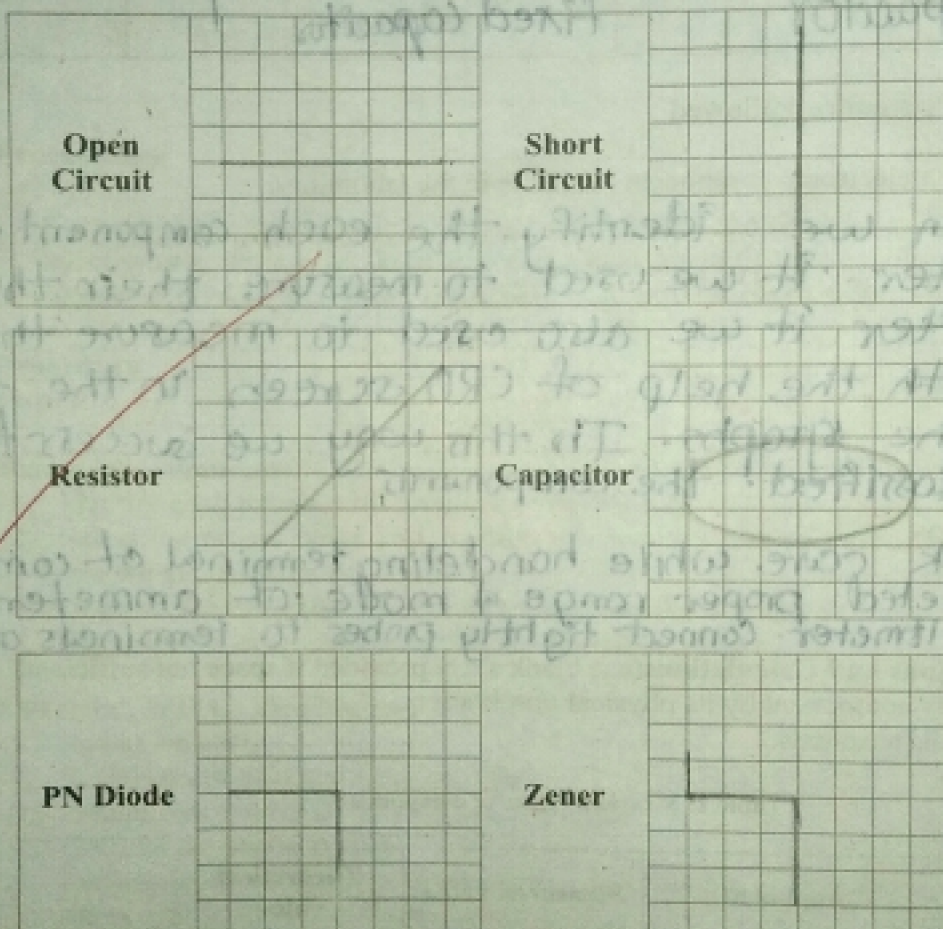
Table 1: Measure values of components

Component	Measured value	Theoretical value
Resistor	1 921 Ω	1k Ω
	2	560 Ω
	3	
Inductor	1	
	2	
	3	

Component	Measured value	Theoretical value
Capacitor	1 110µf 2 3	25V & 1000 µF 25V & 220 µF 10×10⁻⁹ µF

(Minimum 3 components for each)

Draw the waveform obtained on CRO for the various components



XVI Results

From this practical we learnt testing the electronic components on CRO & classified them into active & passive.

XVII Interpretation of results (Give meaning of the above obtained results)

In the practical we learnt about two types of components & seen the diagram on the CRO like some special graphical symbol.

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results)

Hence we had successfully determined the components are Active & passive.

XVIII Practical related Questions

Note: Below given are few sample questions for reference. Teachers must designmore such questionsso as to ensure the achievement of identified CO.

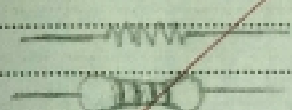
1. Sketch the given components and label them.
2. Write the range of the Multimeter used for measuring 10KΩ resistor. 20 K
3. ....?
4. ....?

[Space for answers]

XVIII

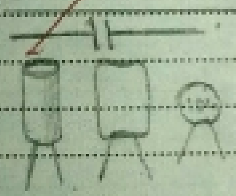
1 ⇒

Resistor:-



Resistor (R):-

Capacitor:-

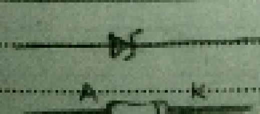


Capacitor (C):-

PN Diode:-

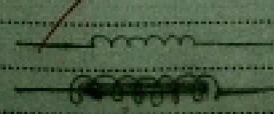
PN Diode

Zener Diode:-



Zener Diode

Inductor



Inductor:

(2) ⇒ for a 10K ohm resistor, many meters, both analogue (moving-coil) & digital will have a 20 kΩ range - so up to 20K ohms FSD (Full scale deflection) or just full scale on a digital meter.

Practical No.3: Test the Performance of the given PN Junction Diode.

I Practical Significance

In industries as well as in domestic appliances PN Junction diode is used in detector circuits, wave shaping circuits and in rectification of DC Power Supplies. For these applications diode selection plays a vital role. In this practical, students will draw V-I characteristics of the given diode to understand unidirectional behavior of diode.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: Apply Electronics engineering knowledge to solve broad-based Computer Engineering related problems.

PO3.Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Computer Engineering problems.

PO4.Engineering tools: Apply relevant technologies and tools with an understanding of the limitations.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use simple electronic circuits of computer system'***:

i. Connect circuits.
ii. Record Measurements.
iii. Analyze Circuits.

IV Relevant Course Outcome(s)

Use of diodes in different applications.

V Practical Outcome

Test the performance of the given PN junction diode:

- Calculate static resistance of a given diode.
- Calculate dynamic resistance of a given diode.
- Determine knee voltage of a given diode.

VI Relevant Affective domain related Outcome(s)

i. Handle components and equipment carefully.
ii. Work in Team.
iii. Aesthetically connecting the circuit.

VII Minimum Theoretical Background

A PN Junction Diode supports uni- directional current flow.

Forward bias

If +ve terminal of the input supply is connected to p-side (anode) and -ve terminal of the input supply is connected to the n-side (cathode), the diode is said to be forward biased. A depletion region is formed in a p-n diode due to the absence of charge carriers. This region gives rise to a barrier potential called cut-in voltage or knee voltage.

When the diode is forward biased, the height of the barrier potential at the junction is lowered by an amount equal to given forward biasing voltage. Both the holes from p-side and electrons from n-side cross the junotion simultaneously and constitute a forward current. The diode is considered as a short circuited switch.

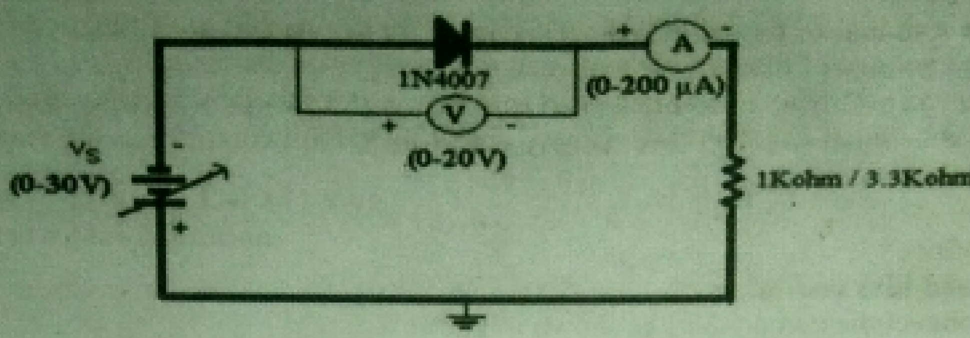
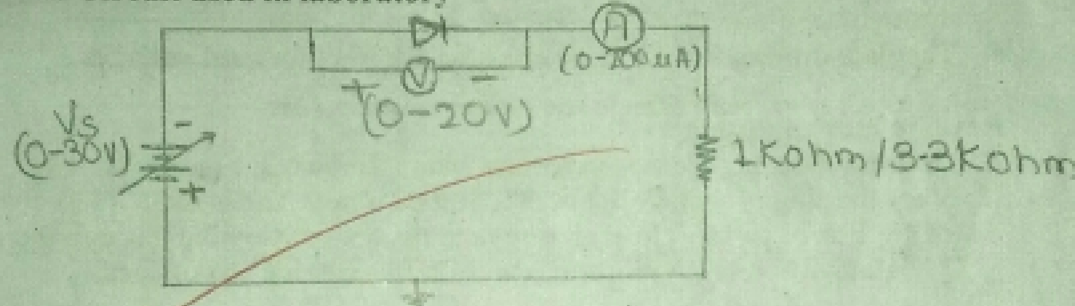
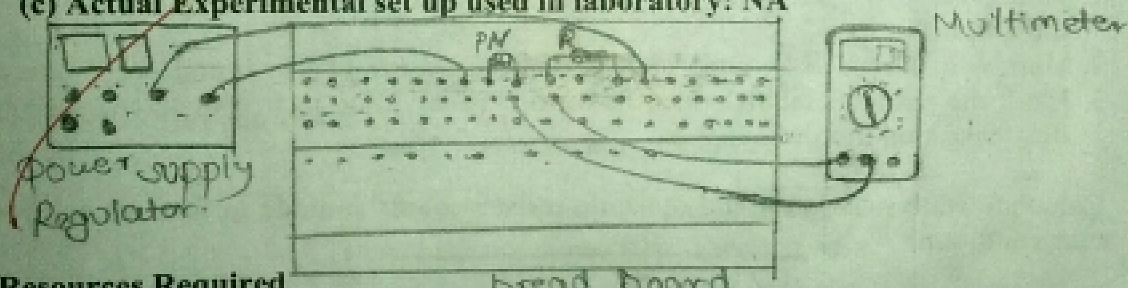


Figure 3: Reverse bias condition

(b) Actual Circuit used in laboratory



(c) Actual Experimental set up used in laboratory: NA



IX Resources Required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	1 No.
2.	DC Regulated power supply	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1 No.
3.	DC Voltmeter	0-20 V	1 No.
4.	DC Ammeter	(0 - 200 mA, 0 - 200 µA)	1 No.
5.	Bread board		1 No.
6.	Diode	IN4007 (or any other equivalent diode)	1 No.
7.	Resistor	1KΩ/ 3.3 KΩ(0.5watts/0.25watts)	1 No.
8.	Connecting wires	Single strand	-
9.	Any other		

X Precautions

1. While doing the experiment do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode.
2. Connect voltmeter and ammeter in correct polarities as shown in the circuit diagram.
3. Do not switch ON the power supply unless the circuit connections are checked as per the circuit diagram.

XI Procedure

Forward bias condition

1. Connect the components as shown in Figure 2.
2. Switch on the power supply.
3. Vary the supply voltage V_S such that the voltage across the silicon diode (V_F) gradually changes from 0 to 0.6 V in steps of 0.1V and then in steps of 0.05 V from 0.6 to 0.76V. For each step (voltage across the diode) record the current flowing through the diode (I_F)
4. Tabulate different forward currents for different forward voltages.

Reverse bias condition

1. Connect the silicon diode in reverse bias as shown in Figure 3.
2. Vary the supply voltage V_S such that the voltage across diode (V_R) changes in steps of 1V from 0 to 10V. In each step note the current flowing through the diode (I_R).
3. Tabulate different reverse currents for different reverse voltages.

Graph

1. Take a cm graph sheet and divide it into 4 equal parts. Mark origin at the center of the graph sheet.
2. Mark +ve X- axis as V_F and –ve X-axis as V_R . +ve Y-axis as I_F and –ve Y-axis as I_R
3. Mark the readings tabulated for forward bias condition in first quadrant and reverse bias condition in third quadrant.

Calculate static resistance and dynamic resistance of the diode in forward and reverse bias condition

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	Multimeter		3 1/2 digit display	1	
2	DC Ammeter		0-200mA, 0-200µA	1	
3	Diode.		PN Diode	1	

XIII Actual Procedure Followed (use blank sheet provided if space not sufficient)

1. We connected the component as shown in the figure
2. figure of reverse & forward biased. We
3. measured the current in Multimeter
4. slowly increased the current from DC Regulator
5. & Marked the values of them in
6. revers bias.

XIV Precautions

1. We took care while doing the Practical & followed the
2. precautions:- Connect volt & Ammeter in correct polarities as shown in the circuit diagram.

XV Observations and Calculations(use blank sheet provided if space not sufficient)
Forward bias condition

Table 1: Measurement of V_F and I_F

S.No.	Forward Voltage across the diode V_F (VOLTS)	Forward Current through the diode I_F(mA)
1	0·1	0·00 mA
2	0·2	0·00 mA
3	0·3	0·00 mA
4	0·4	0·02 mA
5	0·5	0·07 mA
6	0·6	0·14 mA
7	0·7	0·23 mA
8	0·8	0·27 mA
9	0·9	0·37 mA
10	1	0·51 mA
11	2	0·55 MA

Reverse bias condition

Table 2: Measurement of V_R and I_R

S.No.	Reverse Voltage across the diode V_R(VOLTS)	Reverse Current through the diode I_R(μA)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

Calculations :
From graph

Static forward resistance

$R_{dc} = \frac{V_F}{I_F}$

Static reverse resistance

$R_{dc} = \frac{V_R}{I_R}$

Dynamic forward resistance

$r_{ac} = \frac{\Delta V_F}{\Delta I_F}$

Dynamic reverse resistance

$r_{ac} = \frac{\Delta V_R}{\Delta I_R}$

XVI Results

1. Static forward resistance of given diode = 0.9
2. Dynamic forward resistance of given diode = ...
3. Static reverse resistance of given diode = 12 KΩ
4. Dynamic reverse resistance of given diode = ...
5. Knee Voltage of given diode = 0.7 V

XVII Interpretation of Results (Give meaning of the above obtained results)

From this practical we learnt about the connection circut of PN Diode & its cutting voltage, fonctions & its specifications

XVIII Conclusion(Actions/decisions to be taken based on the interpretation of results).

Hence, we successfully understood the concept of ~~wotor~~ forward & reverse Biase of PN Diode By this practical

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Repeat the above experiment for germanium diode and find its knee voltage.
2. Find out the voltage across silicon diode at knee voltage.
3. Find out the voltage across germanium diode at knee voltage.

4.) explain the working of PN junction in forward biasing

[Space for answers]

XIX,

1. find out the voltage across silicon diode at knee voltage.?

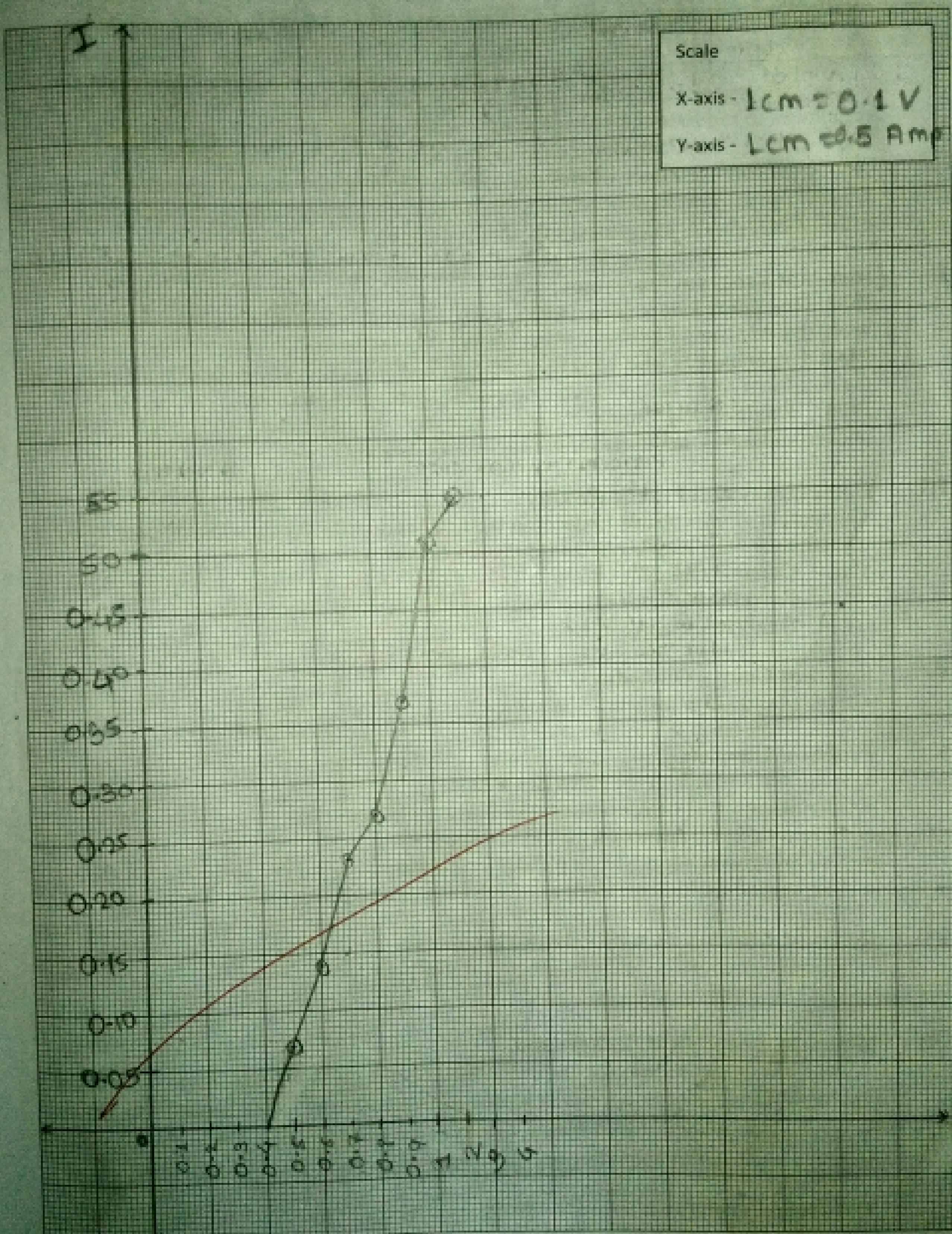
⇒ The knee voltage for silicon diode is approximately 0.7 volt & ~~for a germanium~~

2. ⇒ The knee voltage for germanium is aproximately 0.3 volt. It is the minimum amount of voltage which is required to

operate components.

(3) Repeate the above experiment for germanium diode and find its knee voltage.
⇒ We repeated the above experiment & finded the knee voltage of germanium is 0.3 volt

(4) ⇒ In forward bias the PN Diode operates only in 1 direction. How we increase the voltage we can get the knee voltage at which the voltage directly increase faster (gradually) & at that ~~whow~~ we increase the supply the supply out put in zener diode also increases.


Scale
X-axis - 1cm = 0.1 V
Y-axis - 1cm = 0.5 Amp
I
V
55
50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9

Practical No.4: Test the Performance of the given Zener Diode

I Practical Significance

In industries, Zener diodes are widely used as voltage references and as shunt regulators to regulate the voltage across small circuits, over voltage protection circuits and switching applications. Zener diodes are used in Surge suppression circuitry for device protection. Zener diodes are used in clipping and clamping circuits especially peak clippers. The student will be able to plot the forward and reverse characteristics of the Zener diode and measure the Zener voltage.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: Apply basic electronics engineering knowledge to solve broad-based Computer engineering related problems.

PO3. Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Computer engineering problems.

PO4. Engineering tools: Apply relevant technologies and tools with an understanding of the limitations.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use simple electronic circuits of computer system'***:

i. Connect circuits.
ii. Record Measurements.
iii. Analyse Circuits.

IV Relevant Course Outcome(s)

- Use of diodes in different applications.

V Practical Outcome

Test the performance of the given Zener diode.

- Identification of components
- Mounting components on the circuit board
- Use DC Power supply to give different voltages
- Use Digital multimeter to measure the voltage and current

VI Relevant Affective domain related Outcome(s)

i. Handle components and equipment carefully.
ii. Work in Team.

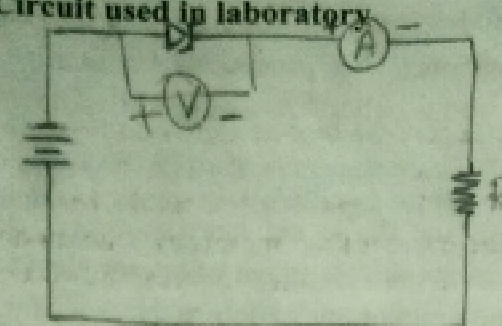
VII Minimum Theoretical Background

Zener diode is a heavily doped silicon diode. It conducts in reverse biased condition. These diodes operate at a precise value voltage called breakdown voltage. A Zener diode when forward biased behaves like a PN junction diode. A Zener diode when reverse biased can undergo avalanche breakdown or Zener breakdown.

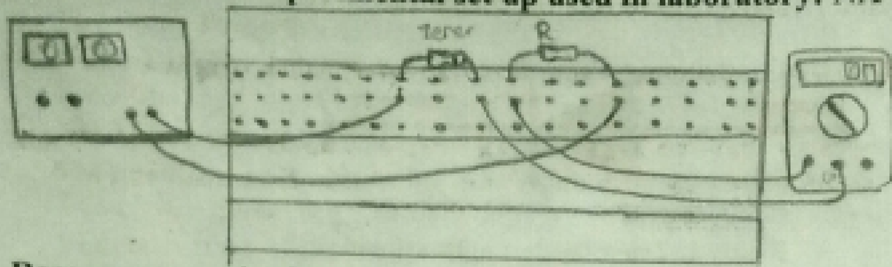
Avalanche Breakdown

If both p-side and n-side of the diode are lightly doped, depletion region at the junction widens. Application of a very large electric field at the junction increases the

(b) Actual Circuit used in laboratory



(c) Actual Experimental set up used in laboratory: NA



IX Resources required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	Digital Multimeter	3 1/2 digit display.	1 No.
2.	DC Regulated power supply	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1 No.
3.	DC Voltmeter	0-20 V	1 No.
4.	DC Ammeter	(0 - 200 mA)	2 No.
5.	Bread board		1 No.
6.	Zener Diode	IN4735 (or any other equivalent diode)	1 No.
7.	Resistor	1KΩ(0.5watts/0.25watts)	1 No.
8.	Connecting wires	Single strand	-
9.	Any other		

X Precautions

1. While doing the experiment do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode
2. Connect voltmeter and ammeter in correct polarities as shown in the circuit diagram.
3. Do not switch ON the power supply unless the circuit connections are checked as per the circuit diagram.

XI Procedure

Forward bias condition

1. Connect the electrical circuit as in Figure 2.
2. Switch ON the power supply.
3. Vary the supply voltage Vs such that the voltage across the Zener diode (V_F) varies gradually from 0 to 0.6 V in steps of 0.1V and then in steps of 0.05 V from 0.6 to

0.76V. For each step (voltage across the diode) record the current flowing through the diode (I_F)

4. Tabulate different forward currents for different forward voltages.

Reverse bias condition

1. Connect the Zener diode in reverse bias as shown in Figure 3.
2. Vary the supply voltage Vs such that the voltage across Zener diode (V_R) changes in steps of 1V from 0 to 6V and in steps of 0.1 V till the breakdown voltage is reached. In each step note the current flowing through the diode (I_R).
3. Tabulate different reverse currents for different reverse voltages.

Graph

1. Take a cm graph sheet and divide it into 4 equal parts. Mark origin at the center of the graph sheet.
2. Mark +ve X- axis as V_F and –ve X-axis as V_R . +ve Y-axis as I_F& –ve Y-axis as I_R.
3. Mark the readings tabulated for forward bias condition in first quadrant and reverse bias condition in third quadrant.

Calculate static resistance and dynamic resistance of the diode in forward bias condition.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	Digital Multimeter		3/2	1	
2	DC Voltmeter		0-20V	1	
3	Bread Board.			1	

XIII Actual Procedure Followed

1. Connect the electrical circuit as per circuit used in laboratory.
2. Switch oned the power.
3. Vary the supply voltage by increasing
4. and note their points & noted the breakdown
5. region. and constant voltage.
6. Tabulated different forward for different
7. Bward voltages.

XIV Precautions

1. Conneted voltmeter & Ammeter carefully
2. Do not switch on the power supply unless the circuit is ready.

XV Observations and Calculations

Forward bias condition

Table 1: Measurement of V_F and I_F

S. No.	Forward Voltage across the diode V_{F}(VOLTS)	Forward Current through the diode I_{F}(mA)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

Reverse bias condition

Table 2: Measurement of V_R and I_R

S. No.	Reverse Voltage across the diode V_{R}(VOLTS)	Reverse Current through the diode I_{R}(mA)
1	0	0
2	0.5	0.01
3	1	0.02
4	1.5	0.04
5	2.5	0.06
6	3	0.07
7	3.5	0.08
8	4	0.10
9	4.5	0.12
10	5	0.13
11	5.5	0.15
	6	0.16
	6.5	0.18
	7	0.19
	7.5	0.28
	8	0.77
	8.5	2.27
	9	2.77

Calculations :

From graph :

Static forward resistance

$$R_{dc} = \frac{V_F}{I_F}$$

Dynamic forward resistance

$$r_{ac} = \frac{\Delta V_F}{\Delta I_F}$$

XVI Results

a. Zener breakdown voltage = ~~0.28~~ 7.5V
b. Static forward resistance of Zener diode = ...
c. Dynamic forward resistance of Zener diode = ...

XVII Interpretation of results (Give meaning of the above obtained results)

By this practical we learnt: we learnt about Zener Breakdown & constant voltage.

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results).

Hence, we succesfully find, the Breakdown voltage in zener diode at which the voltage is constant

XIX Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

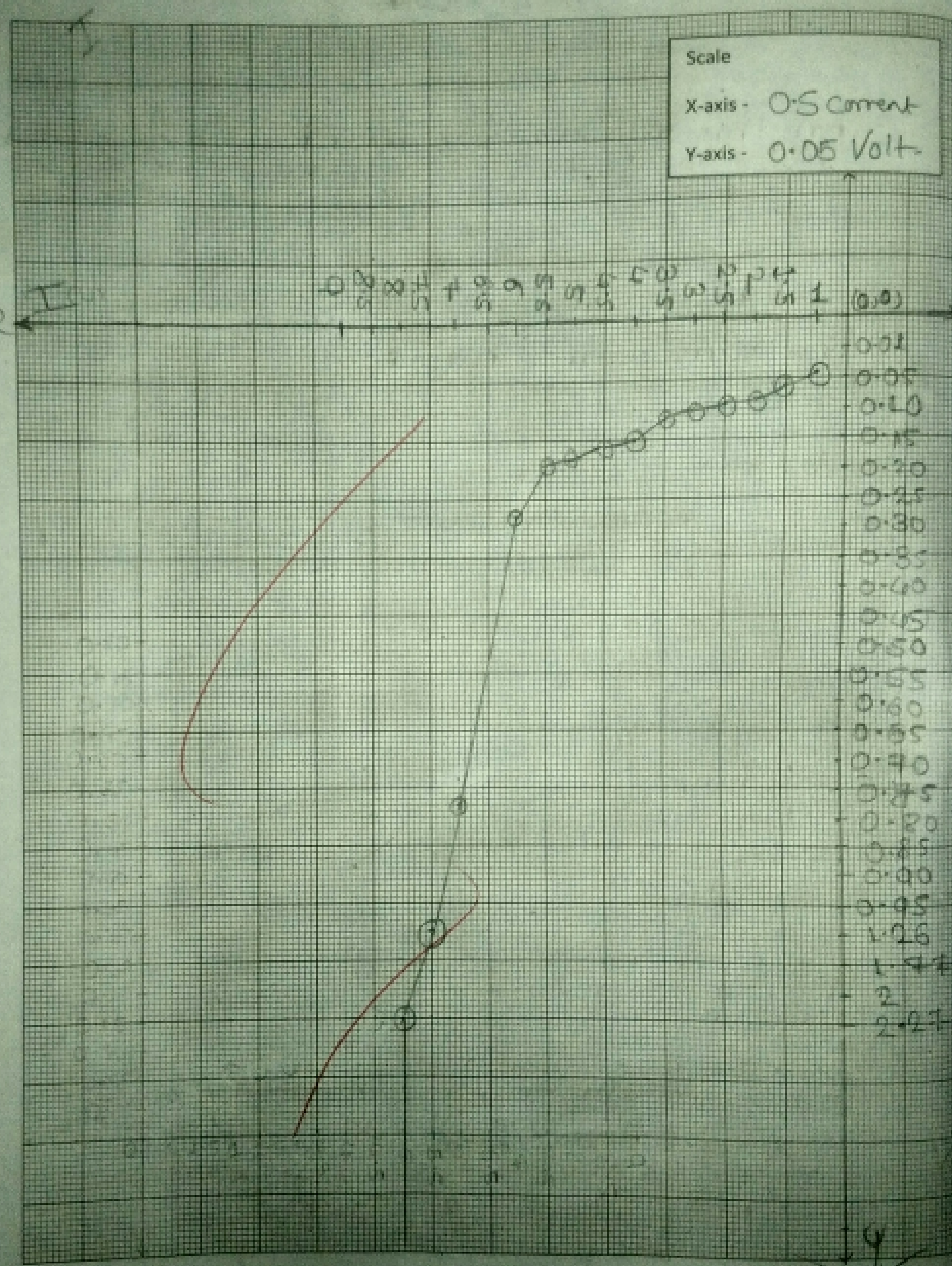
1. State the value of Zener voltage for the given Zener diode?
2. State the maximum value of reverse current for the given Zener diode?
3. Explain the detail working of zener diode in reverse Biased.?

[Space for answers]

1) ⇒ The zener voltage of zener diode comes in a range of values. we can find them in 3.3v–12v easily in widespread use. The circuit below has a Zener voltage of 5.1v. Therefore, the 12 volt power supply drops 5.1v and the voltage across the zener remains constant at this voltage.

2) ⇒ The value of reverse current is generally in few microamperes when the input voltage is lower than the Zener breakdown voltage. In the case of higher input voltage than the Zener breakdown voltage, the maximum value of reverse current is limited only by the maximum power than the Zener can handle.
It is the silicon crystal diode having a special reverse current.

3) ⇒ The working in reverse biased of zener diode is that the voltage remains constant aftere breakdown of zener diode.
The voltage remains constant but the current increases. it is fixed breakdown of the zener diode, it depends on the manufacturing to which the voltage remain contant.


Scale
X-axis - 0.5 Current
Y-axis - 0.05 Volt
(0,0)

Practical No.5: Test the Performance of the Given Zener Voltage Regulator

I Practical Significance

In industries, it is required to provide regulated power supply to various circuits and Integrated Circuits. Zener diode finds a wide application commercially and industrially. The reverse characteristics of Zener diode exhibit a constant voltage across the device and allow the current to increase through it without damage up to certain level. Zener diodes have a primary application as a voltage regulator. Various electronic equipments and circuits require regulated power supply which can be provided by Zener regulator.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: Apply basic electronics engineering knowledge to solve broad-based Computer engineering related problems.

PO3. Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Computer engineering problems.

PO4. Engineering tools: Apply relevant technologies and tools with an understanding of the limitations.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency '***Use simple electronic circuits of computer system***':

I Connect circuits.
II Record Measurements.
III Analyze Circuits.

IV Relevant Course Outcome(s)

Use of diodes in different applications.

V Practical Outcome

Test the performance of the given Zener diode voltage regulator:

(i) Identification of components.
(ii) Mounting components, connect inputs and measure outputs.
(iii) Vary the input voltage.
(iv) Use Digital multimeter to measure the voltage and current.

VI Relevant Affective domain related Outcome(s)

i. Careful handling of components and circuits.
ii. Visually aesthetic connections.

VII Minimum Theoretical Background

Zener diode is designed to operate in the breakdown region without damage by changing the doping level. It is possible to construct Zener diode with required breakdown voltage in reverse bias condition.

After breakdown, Zener diode acts as a constant voltage source i.e. if the applied reverse voltage exceeds the Zener voltage, it keeps the voltage across the device constant. Since it acts as a constant voltage regulator i.e. it keeps the output voltage constant irrespective of changes in load current or changes in input voltage.

VIII Practical Circuit diagram

i. **Sample**

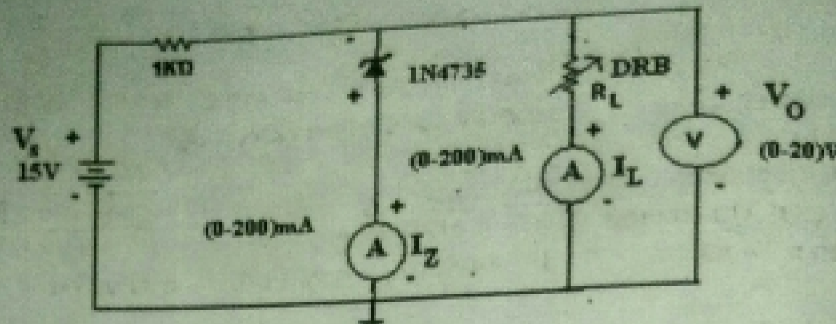


Figure 1: Load Regulation

Courtesy:https://www.google.co.in/search?q=zener+diode+as+voltage+regulator+experiment&sa=X&dcr=

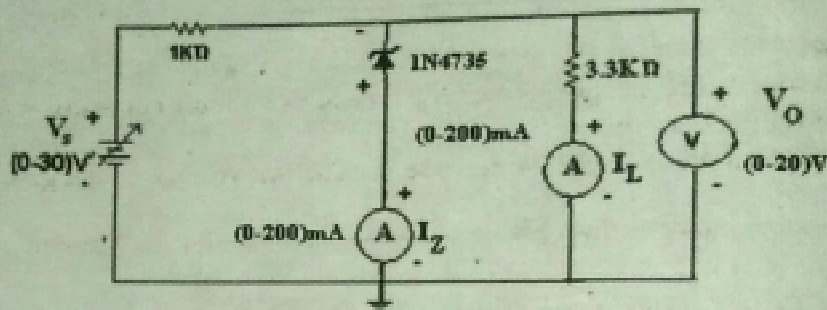
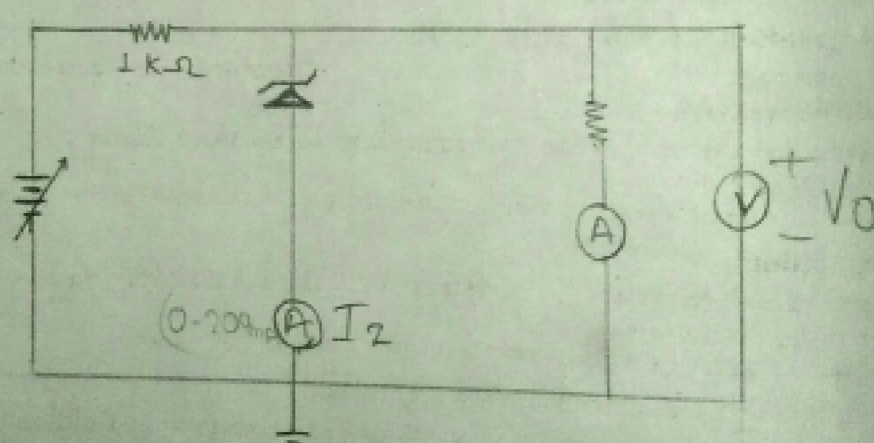


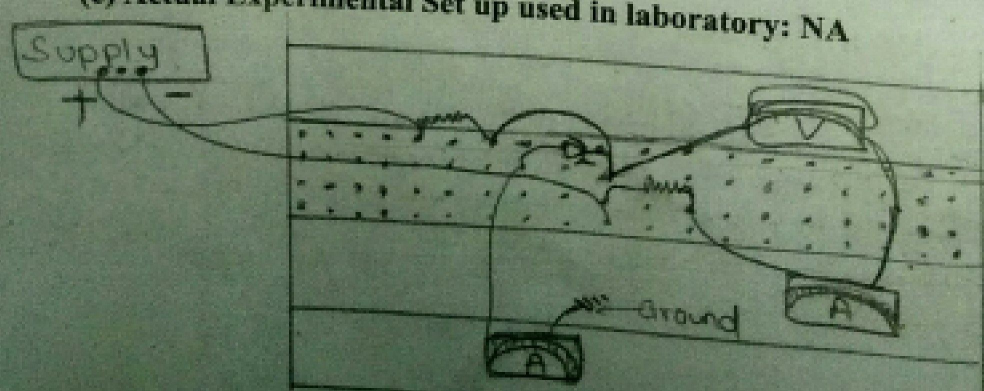
Figure 2: Line Regulation

Courtesy:https://www.google.co.in/search?q=zener+diode+as+voltage+regulator+experiment&sa=X

(b) Actual Circuit used in laboratory



(c) Actual Experimental Set up used in laboratory: NA



IX Resources Required

Sr. No.	Name of Resource	Suggested Specification	Quantity
I	DC Regulated Power supply	Variable DC power supply 0-30V,2A display for current & voltage	1 No.
II	DC Ammeter	0-200 mA	02
III	Digital Multimeter	3 ½ digit display	01
IV	Zener Diode	IN 4735(or any other equivalent diode)	01
V	Resistor	1K, 3.3KΩ	2 Nos.
VI	Potentiometer	10KΩ	01
VII	Connecting Wires		

X Precautions

1. Do not switch ON the power supply unless the circuit connection are checked as per the circuit diagram.
2. See the data sheet to know the reverse breakdown voltage of the given diode before starting the experiment.
3. Connect Voltmeters/Ammeters in correct polarities as shown in the circuit diagram.
4. Switch OFF the power supply after taking reading.

XI Procedure

1. Connect the circuit as per the circuit diagram.
2. Switch ON the power supply.

Load Regulation :(Keep the Input voltage at 5V – 10V)

1. By changing the Load Resistance, R_L Measure the corresponding output (Voltmeter) voltage.
2. Measure the current in the two ammeters to measure Zener current I_Z and Load current I_L.

Line Regulation:

1. Keep the Load resistance R_L constant. Vary the input supply V_S &note down the corresponding output voltage.

Graph

Plot the graph of Load current I_L(X-axis) Versus Load voltage V_O (Y-axis)

Plot a graph between Input voltage V_s(X-axis) Versus Output Voltage V_O (Y-axis)

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	DC Ammeter		0-200 mA.	2	
2	Digital Multimeter		3 ½ digital display	1	
3	Zener diode		IN4735 .	1	

XIII Actual Procedure Followed (use blank sheet provided if space not sufficient)

1. ....
2. ....
3. ....
4. ....
5. ....
6. ....
7. ....

XIV Precautions

1. We not on the power supply unless the connections
2. are corrected. connected voltmeter ammeter in correct polarities

XV Observations and Calculations (use blank sheet provided if space not sufficient)

a. Load Regulation

Input Voltage V_S = ---------

Table: 1

Sr. No	I_Z(mA)	I_L(mA)	V_O(V)

Calculation: No Load Voltage V_{NL}- Output voltage across R_L when Load current is minimum. Full load Voltage V_{FL}- Output voltage across R_L when Load current is maximum.

b. Line Regulation

Table: 2

Sr. No	V_S(V)	I_Z (mA)	I_L (mA)	V_O(V)
1	0	0.00		
2	0.5	0.01		
3	1.5	0.02		
4	2	0.04		
5	2.5	0.06		
6	3	0.07		
7	3.5	0.08		
8	4	0.10		
9	4.5	0.12		
10	5	0.13		
11	5.5	0.15		
12	6	0.18		
13	6.5	0.19		
14	7	0.24		

Calculations:

i. Load Regulation= $\frac{V_{NL}-V_{FL}}{V_{FL}}$ x 100 (From Table: 1)

ii. Line Regulation= $\frac{\Delta V_0}{\Delta V_S}$ x 100 (From Table: 2)

XVI Results

1. % Load Regulation= ....
2. % Line Regulation= ....4.PS..............................

XVII Interpretation of Results (Give meaning of the above obtained results)

we measured the load regulation & line regulation and Input voltage from this practical.

XVIII Conclusions(Actions/decisions to be taken based on the interpretation of results).

Hence, we successfully understood the practical by calculating load regulation line regulation.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questions so as to ensure the achievement of identified CO.

1. Give the value of input voltage when Zener current starts increasing?
2. For what value of Load resistance the Load current is Minimum?
3. For what value of Load resistance the Load current is Maximum?

[Space for answers]

1) form most zener diode current starts increasing marked of around 9.8 % to 9 % of related. vltg defination: of knee voltage region can

change between manetactuning of ever betw
change between manefacture with the
re-zener for given man 0.25 etc.
quite of few diode.

2) Lack of a minimum load & verses in a resource vltg that is higher that derived. This could resource in damaging to the power source electronics & it could simply a mared to load.

The load curent will always be minimum when the load resistance is at maximum.

3) ⇒ In our them equivalent circuit above the maximum amount of power tractmer of power will be dissipated in the load resistance if it is equal in resistance value to rer a source of vltg networke supplying the power

Practical No.6: Convert AC Signal into DC Signal Using Half Wave Rectifier (HWR)

I Practical Significance

Electrical energy is distributed as alternating current because AC Voltage can be increased or decreased with the help of transformers. This allows power to be transmitted through power lines efficiently. AC voltage is represented as sine wave voltage. For certain electronic applications like computers, DC power supply is required. Rectifier is a circuit that converts AC to pulsating DC. The student will be able to analyze the unidirectional behavior of diode for rectification.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

PO3. Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use simple electronic circuits of computer system'***:

i. Connect Circuits
ii. Record measurements.
iii. Observe waveforms
iv. Analyze results

IV Relevant Course Outcome(s)

Use diodes in different applications.

V Practical Outcome

Convert AC signal into DC signal using Half Wave Rectifier.

i. Identify terminals of the component.
ii. Mount the circuit components of Half Wave Rectifier.
iii. Use functions of CRO required for Half Wave Rectifier
iv. Evaluate performance of Half Wave Rectifier by observing Output DC voltage waveform

VI Relevant Affective domain related Outcome(s)

i. Handle equipments and components carefully
ii. Work in team

VII Minimum Theoretical Background

Rectifier is an electronic circuit used for converting a pure AC into a pulsating DC and this process of conversion is known as Rectification. A half wave rectifier uses a single diode to carry out this conversion. During the positive half cycle of the input wave, the diode will be forward biased and it conducts and hence current flows through the load resistor. During the negative half cycle of input wave, the diode will be reverse biased and it is equivalent to an open circuit. Hence current through load resistance is zero. Thus, the rectifier (diode) conducts current during positive half cycle of AC input and does not conduct current during negative half cycle. This is called **half wave rectification.** Rectifier performance is based on efficiency of output.

Ripple factor:
Ripple factor is defined as the ratio of the effective value of AC components to average DC value. It is denoted by the symbol 'γ'.

$\gamma = \text{—}$

For Half Wave Rectifier (HWR),

Ripple factor = —— = 1.21

VIII Practical Circuit diagram:

(a) Sample

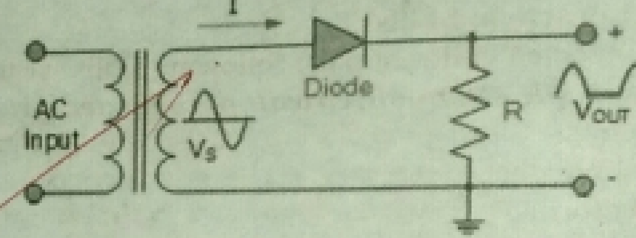
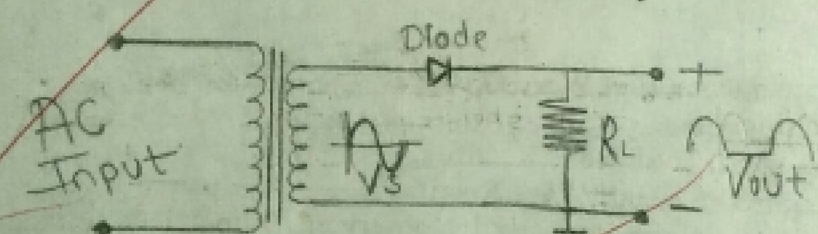
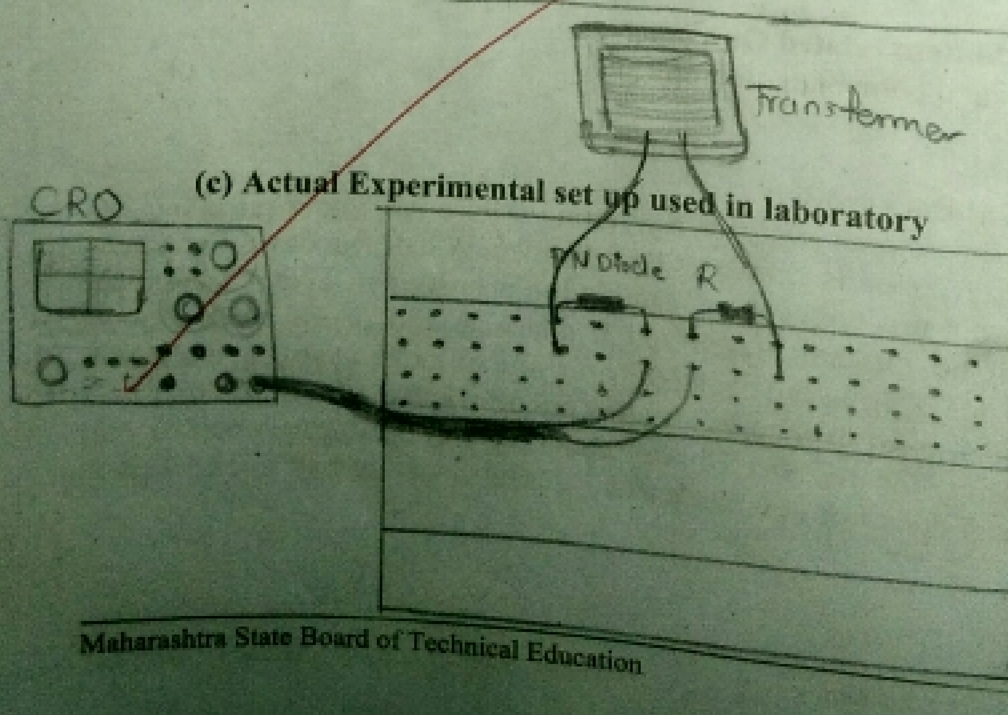


Figure1: Half Wave Rectifier

(b) Actual Circuit used in laboratory



(c) Actual Experimental set up used in laboratory



IX Resources Required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	CRO	0-20MHz (Dual Trace)	1
2.	DC Voltmeter	0-20 V	1 No.
3.	DC Ammeter	(0 - 200 mA, 0 - 200 μA)	1 No.
4.	Bread board		1 No.
5.	Transformer	220V/9V AC, 500 mA	1 No.
6.	Diode	1N4001 (or any other equivalent diode)	1 No.
7.	Resistor	1KΩ (0.5watts/0.25watts)	1 No.
8.	Connecting wires	Single strand	-
9.	CRO Probes		2

X Precautions

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. While doing the experiment do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode
3. Connect voltmeter and ammeter in correct polarities as shown in the circuit diagram.

XI Procedure

1. Connect the Electronic circuit for half wave rectifier on bread board as shown in Figure 1.
2. Connect the primary side of the transformer to AC mains. Connect the CRO probe across the secondary and measure the V_{inp-p} appearing across diode. Now connect the probes across the resistance R.
3. Keep CRO in DC mode, adjust the zero dc level and measure accurately the peak value of output voltage (V_m).
4. Trace the waveforms.
5. Calculate the average or dc value of output voltage and frequency of the waveform
6. Using a DC voltmeter, measure the DC voltage across the load resistance (V_{dc})
7. Measure the AC voltage across the load resistance by setting multi-meter to AC mode (V_{ac}).
8. Calculate Ripple factor.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	CRO		0-20MHz (Dual	1	
2	DC voltmeter		0-20V.	1	
3	DC Ammeter		0-200mA, 0-200μA	1	

XIII Actual Procedure Followed

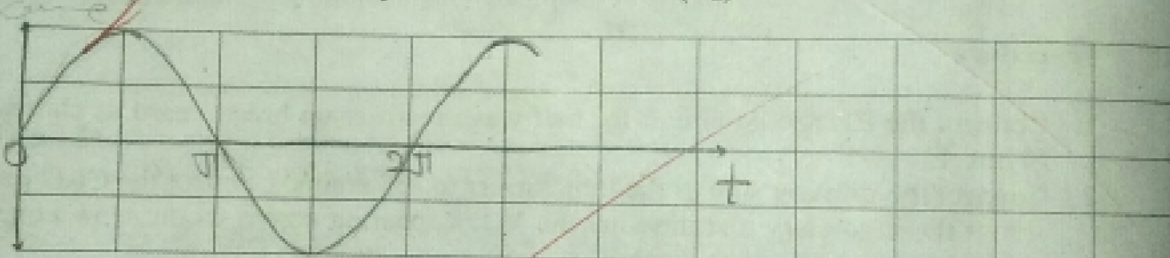
1. Connect the electrical circuit as per Circuit used in laboratory.
2. connected the primary side of transformer to
3. AC. connect CRO probe . keep CRO in dc mode
4. Keep cro & tarce the waveform
5. Calculate the average or d.c. ~~current~~ value of
6. voltage using DC voltmeter
7. calculate Ripple factor

XIV Precautions

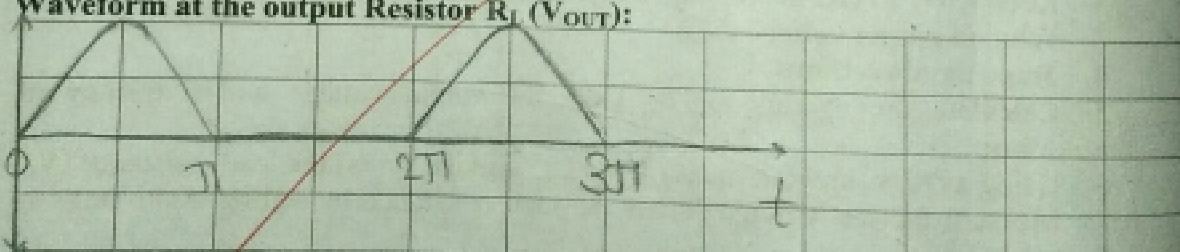
1. Do not on switch unless you have connected it corectly
2. do not touch the open circuit.
3. connected voltmeter & ammeter in correct polarities.

XV Observations and Calculations:

A. Waveform at Secondary of the Transformer (V_S):



Waveform at the output Resistor R_L (V_{OUT}):



B.

Table: 1

Load Resistance(R_L)	V_{ac}(V)	V_{dc}(V)	Ripple Factor $=\frac{V_{ac}}{V_{dc}}$	Input Signal		Output Signal	
				Vin p-p(V)	Frequency (Hz)	Vin p-p(V)	Frequency (Hz)
1K	12V	12V	1	2uV	50 Hz		50Hz

C. Calculation

$V_{dc} = \frac{V_m}{\pi} =$ 3.81 V

Ripple Factor $\frac{V_{ac}}{V_{dc}}$ 1

Theoretical value of Ripple factor = 1

XVI Results

V_{dc} calculated = 12 V

Ripple factor = 1

XVII Interpretation of results (Give meaning of the above obtained results)

We learnt to convert A.C. signal to DC signal using Half wave rectifier (HWR) from this practical.

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results).

Hence, from this practical we learnt about converting A.C. signal ~~into~~ DC signal using Half wave rectifier (HWR)

XIX Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

1. State the effect on output voltage if we replace silicon diode with germanium diode.
2. If V_{dc} = 2 V, What will be the value of V_m?

[Space for answers]

1) ⇒ The output voltage if we replace silicon diode with germanium diode is that ~~still~~ silicon has larger potential barrier i.e 0.7V then germanium i.e 0.3V. so, in germanium we got knee voltage at 0.3V

2) ⇒ We know,

$$V_{dc} = \frac{1}{T}\int_0^T V(t)\,dt$$

Here, T is time period.
$v(t) = V_m \sin\omega t$

Now,
$$V_{dc} = \frac{1}{2\pi} \int_0^{2\pi} V_m \sin\omega t \, dt$$

$$= \frac{1}{2\pi} \left[\int_0^{\pi} V_m \sin\omega t \, dt + \int_{\pi}^{2\pi} 0 \, dt \right]$$

$$= \frac{1}{2\pi} V_m \left[-\cos\omega t \right]_0^{\pi}$$

$$= \frac{V_m}{\pi} = 0.318 V_m$$

Hence, $V_{dc} = 0.318 V_m$
If $V_{dc} = 2V$ then, $V_m = 2V / 0.318 =$
$V_m = 6.28V$

Practical No.7: Convert AC Signal into DC Signal Using Full Wave Rectifier.

I Practical Significance

Electrical energy is distributed as alternating current because AC voltage can be increased or decreased with the help of transformers. This allows power to be transmitted through power lines efficiently. AC voltage is represented as sine wave voltage. For certain electronic applications like computers, DC power supply is required. Rectifier is a circuit that converts AC to pulsating DC. In this experiment students will observe the working of full wave rectifier and can compare its performance with half wave rectifier.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

PO3. Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use simple electronic circuits of computer system'***:

i. Connect Circuits
ii. Record measurements.
iii. Analyze results
iv. Observe waveforms on CRO

IV Relevant Course Outcome(s)

- Use diodes in different applications

V Practical Outcome

Convert AC signal into DC signal using Full Wave Rectifier:

- Identify terminals of the component.
- Mount circuit components of full wave rectifier.
- Observe performance of full wave rectifier by Output DC voltage waveform
- Compare with half wave rectifier.

VI Relevant Affective domain related Outcome(s)

i. Handle equipments and components carefully
ii. Work in team

VII Minimum Theoretical Background

Rectifier is an electronic device used for converting AC into DC and this process is known as Rectification. Like the half wave circuit, a full wave rectifier circuit produces an output voltage or current which is pulsating DC or has some specified DC component. Full wave rectifier utilizes both the cycle of input AC voltage. Two diodes are used in full wave rectifier. Center Tapped Full wave rectifier using two diodes is shown in the following figure. Center tapped transformer is used in this full wave rectifier. During the positive cycle diode D_1 conducts and it is available at the output. During negative cycle diode D_1 remains OFF but diode D_2 is in forward bias hence it conducts and negative cycle is available as a positive cycle at the output as shown in the following figure. Note that direction of current in the load resistance is same during both the cycles hence output is only positive cycles.

Ripple factor:

Ripple factor is defined as the ratio of the effective value of AC components to the average DC value. It is denoted by the symbol 'γ'.

$\gamma = \frac{}{}$

For Full Wave Rectifier (FWR),

Ripple factor $= \frac{}{} = 0.48$

VIII Practical Circuit diagram:

(a) Sample

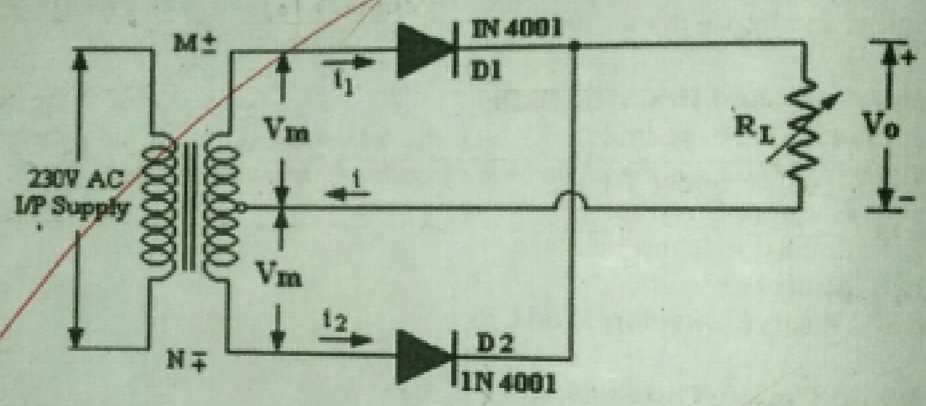
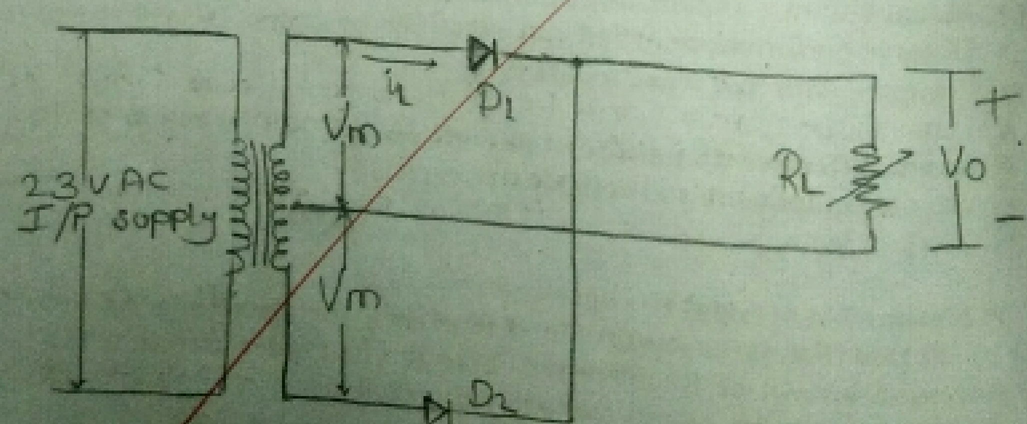
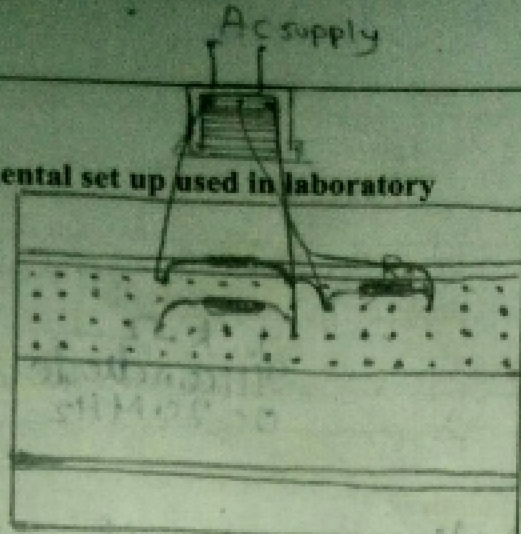


Figure 1: Full Wave Rectifier

(b) Actual Circuit used in laboratory



(c) Actual Experimental set up used in laboratory



IX Resources required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	Transformer (center tapped)	12-0-12 V AC, 500 mA	1 No.
2.	Resistor	1K Ω	1 No.
3.	Diode	Silicon Diode 1N4001/7	2 No.
4.	Digital Multimeter	Digital Multimeter : 3 1/2 digit display.	1 No.
5.	Connecting wires	Single Strand	1 No.
6.	CRO	0-20 MHz(Dual Trace)	1 No.
7.	CRO Probes	-	2 No.

X Precautions

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. While doing the experiment do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode
3. Connect voltmeter and ammeter in correct polarities as shown in the circuit diagram.

XI Procedure

1. Connect the Electronic circuit for Center Tapped Full wave rectifier on bread board as shown in Fig 1.
2. Connect the primary side of the transformer to AC mains. Connect the CRO probe across the secondary and measure the V_{inp-p} appearing across diode. Now connect the probes across the resistance R_L.
3. Keep CRO in DC mode, adjust the zero dc level and measure accurately the peak value of output voltage (V_m).
4. Trace the waveforms.
5. Calculate the average or dc value of output voltage and frequency of the waveform
6. Using a DC voltmeter, measure the DC voltage at the load resistance (V_{dc})
7. Measure the AC voltage across the load resistance by setting multi-meter to AC mode (V_{ac}).
8. Calculate Ripple factor

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	Resistor		1 kΩ	1	
2	Diode		Silicon diode	2	
3	CRO		0-20MHz	1	

XIII Actual Procedure Followed

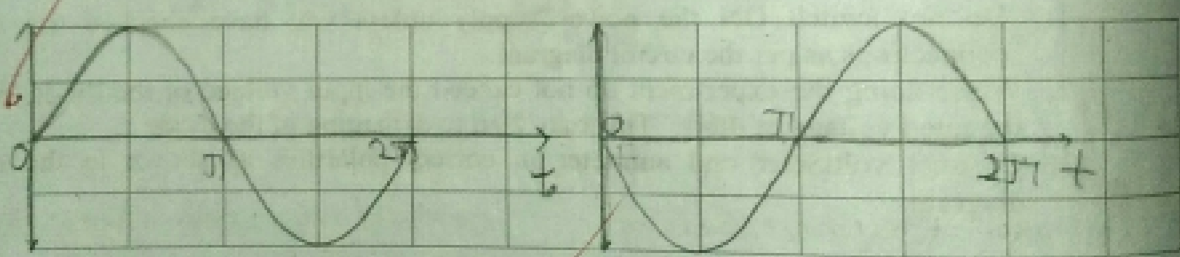
1. Connected the circuit of center tab full wave
2. rectifier on breadboard.
3. connected primary side of transformer
4. to AC mains & secondary to circuit.
5. Measure the AC voltage across resister
6. by setting multimeter to AC-mode

XIV Precautions

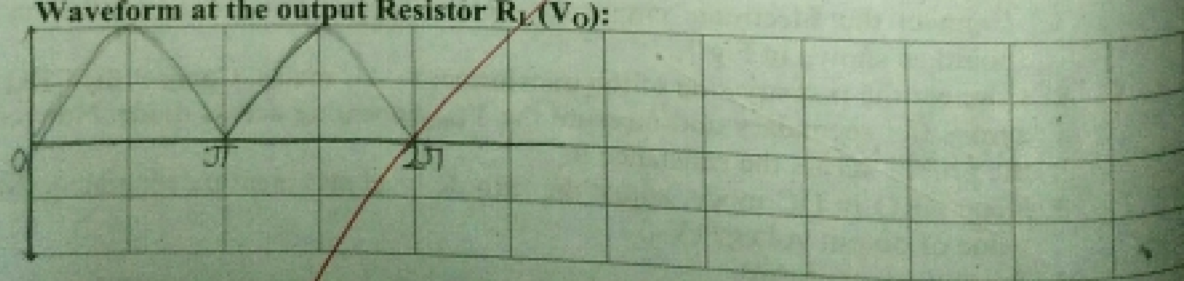
1. We not on the power supply until the circuit checked
2. connected voltmeter & ammeter in correct polarities.

XV Observations and Calculations

A. Waveform at Secondary of the Transformer (V_m):



Waveform at the output Resistor R_L (V_O):



B.

Table 1

Load Resistance(R_L)	V_{ac}(V)	V_{dc}(V)	Ripple Factor = $\frac{V_{ac}}{V_{dc}}$	Input Signal		Output Signal	
				Vm p-p(V)	Frequency (Hz)	Vm p-p (V)	Frequency (Hz)
1K	13V	8.72V	1.57	26V	25Hz	26V	25Hz

C. Calculations:

$V_{dc} = \frac{2V_m}{\pi} =$ 8-27 V

Ripple factor = $\frac{V_{ac}}{V_{dc}} =$ 1.57

Theoretical Ripple factor = 121.1

XVI Results

V_{dc} calculated = 8.27 V

Ripple factor = 1.57

XVII Interpretation of results

Vdc calculated = 8.27 V

Ripple factor = 1.57

XVIII Conclusions

Hence, from this Practical to convert A.C signal into DC signal using full wave Rectifier.

XIX Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

1. Define ripple factor.
2. Compare half wave and Full wave rectifier based on output waveforms obtained in laboratory.

① Q
→ Ripple ~~factor~~ is ~~the~~ ratio of RMS value of AC component prsent in the rectified output to the average value of rectifier output It is a dimentionss quality & diode by Its value is always less than 1

② → Half wave rectifier
1) It operated only at alternate Half cycle.
2) Its can electronic circuit which consirt only of Half AC cycle in pulsating DC only (positive cycle is seen).
3) It is an undirectional it allow's in case direction only it convert positive half wave negative half into DC
It do not have negative half cycle.

②) ~~full~~ wave Rectifier
1) It operated at all cycles.
2) Its an electric circuit which converted full cycle of AC into pulsating DC
3) It is bi-directionel it conduct for positive half as well as negative half of the cycle
4) In output the positive cycle repuling is seen. for one cyche there is two positive cyele only seen.

Practical No.8: Use Filters to Get Regulated DC

I Practical Significance

The devices which converts the pulsating DC into pure DC is called filter. Voltage regulator keeps the terminal voltage of the D.C. power supply constant, even if the a.c. input to the transformer varies or the load varies. The electronic reactive elements like capacitor and inductors are used to perform this function. In this experiment the student will be able to test the performance of L, C, LC and CLC filters.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

PO3. Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency '***Use simple electronic circuits of computer system***':

i. Connect Circuits
ii. Record measurements.
iii. Observe waveforms
iv. Analyze results

IV Relevant Course Outcome(s)

Use diodes in different applications

V Practical Outcome

Use filters to get regulated DC
(i) Identify terminals of the component.
(ii) Connect circuit Components of Half Wave Rectifier with filter
(iii) Connect circuit components of Full Wave Rectifier with filter.
(iv) Observe and compare performance of Half Wave Rectifier and Full Wave Rectifier with filters.

VI Relevant Affective domain related Outcome(s)

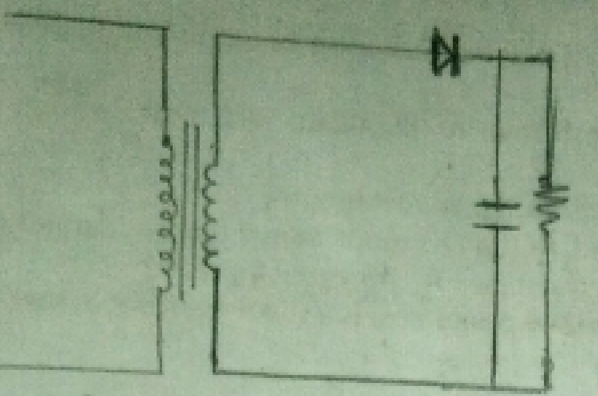
i. Handle the components with care
ii. Make Aesthetically clean connections
iii. Work in team
iv. Follow ethical practices

VII Minimum Theoretical Background

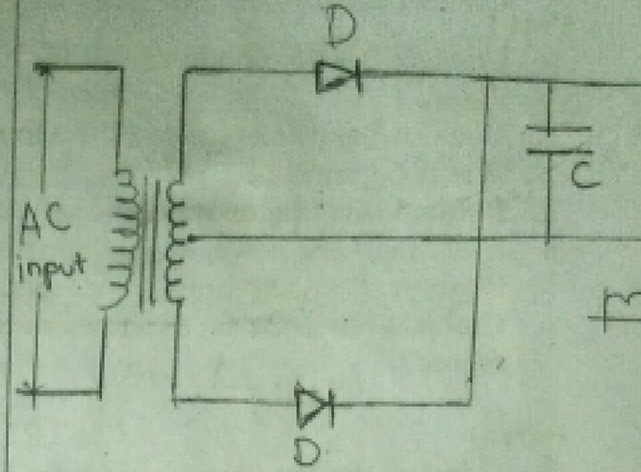
A rectifier is a circuit that converts a pure AC signal into pulsating DC signal or a signal that is a combination of AC and DC components. In DC supplies, a rectifier is followed by a filter circuit which converts the pulsating DC signal into pure DC signal by removing the AC component.

A filter circuit consists of passive components like resistor, inductor, capacitor and their combination. For example, an inductor allows DC to flow through it but blocks AC On the other hand, capacitor allows to flow AC through it, but blocks DC.

(b) Actual Circuit used in laboratory

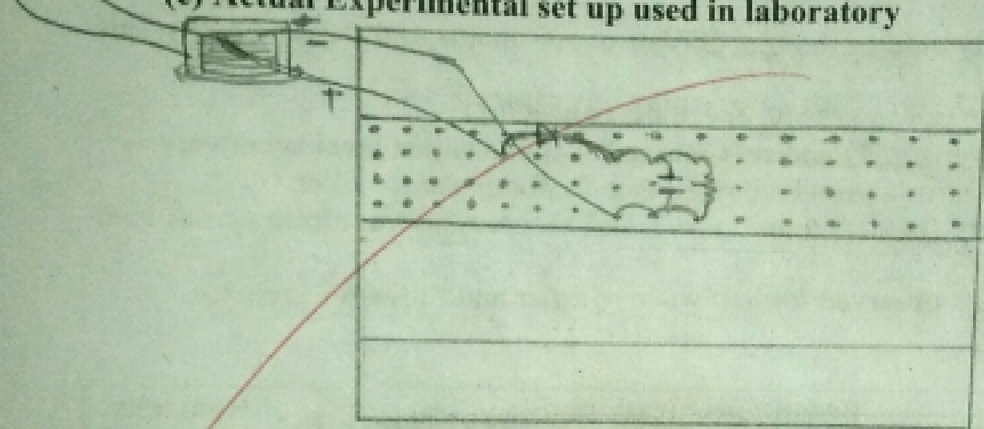


Half wave rectifier
with capacitor filter



AC

(c) Actual Experimental set up used in laboratory



IX Resources required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	Transformer (center tapped)	6-0-6 V AC, 500 mA	1 No.
2.	Resistor	1K Ω	1 No.
3.	Diode	Silicon Diode IN4007	2 No.
4.	Digital Multimeter	3 1/2 digit display.	1 No.
5.	Capacitor, Inductor	2.2µF, 720mH	1 No.
6.	C.R.O.	0-20 MHz(Dual trace)-	1 No.
7.	Connecting wires	Single Strand	1 No.
8.	Any other		

X Precautions

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. While doing the experiment do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode
3. Connect voltmeter and ammeter in correct polarities as shown in the circuit diagram.

XI Procedure

Part I

1. Connect the Electronic circuit for half wave rectifier on bread board as shown in Figure 1.
2. Connect the primary side of the transformer to AC mains and the secondary side to rectifier input.
3. Before switching on power supply, check the connection.
4. Switch ON the power supply and set CRO in DC mode adjust level accurately.
5. Observe the Waveforms across load resistance R_L for capacitor filter.
6. Connect the inductor as shown in Figure 5 and observe the waveform across load resistor

Part II

1. Connect the Electronic circuit for Full wave rectifier on bread board as shown in Figure 2.
2. Connect the primary side of the transformer to AC mains and the secondary side to rectifier input.
3. Before switching on power supply, check the connection.
4. Switch ON the power supply and set CRO in DC mode adjust level accurately.
5. Observe the Waveforms across load resistance R_L for capacitor filter.
6. Connect the inductor as shown in Figure 5 and observe the waveform across load resistor
7. Compare waveforms observed for half wave rectifier and full wave rectifier.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1)	Resistor		1k Ω	2	
2)	Diode		Silicon Diode	1	
3)	Digital Multimeter		3 1/2 digital display	1	

XIII Actual Procedure Followed

1. Connected the electronic circuit for half wave
2. rectifier on bread board.
3. Connected primary side of the transformer to AC
4. mains and the secondary side to rectifier input.
5. Before switching on power supply, checked the
6. connection.

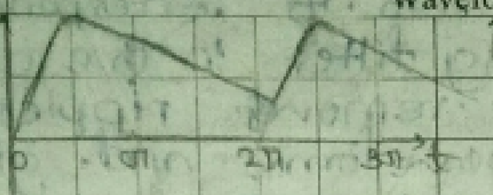
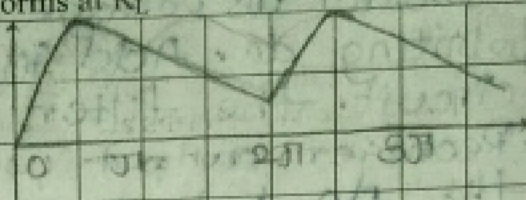
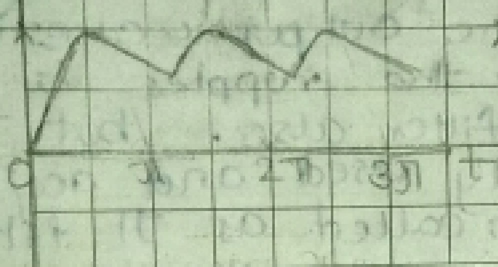
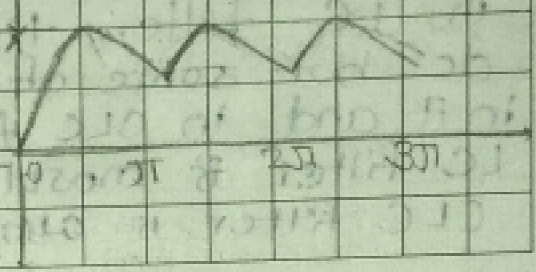
XIV Precautions

• We not on the supply until the connections are checked.

• We not extended the input voltage of diode greater than rated voltage.

XV Observations and Calculations

Table 1

Type of Rectifier	Type of filter: C filter	Type of filter: L filter
	Waveforms at R_L	
Half wave rectifier		
Full wave rectifier		

XVI Results

Hence, from this practical we learnt about the use of filter & created a circuit used for Regulation

XVII Interpretation of results (Give meaning of the above obtained results)

We learnt that How to make the filter circuit and its uses as regulation from this practical.

XVIII Conclusions - (Actions/decisions to be taken based on the interpretation of results).

Hence, we successfull understood the practical of the filter used as a regulator.

XIX Practical related Questions

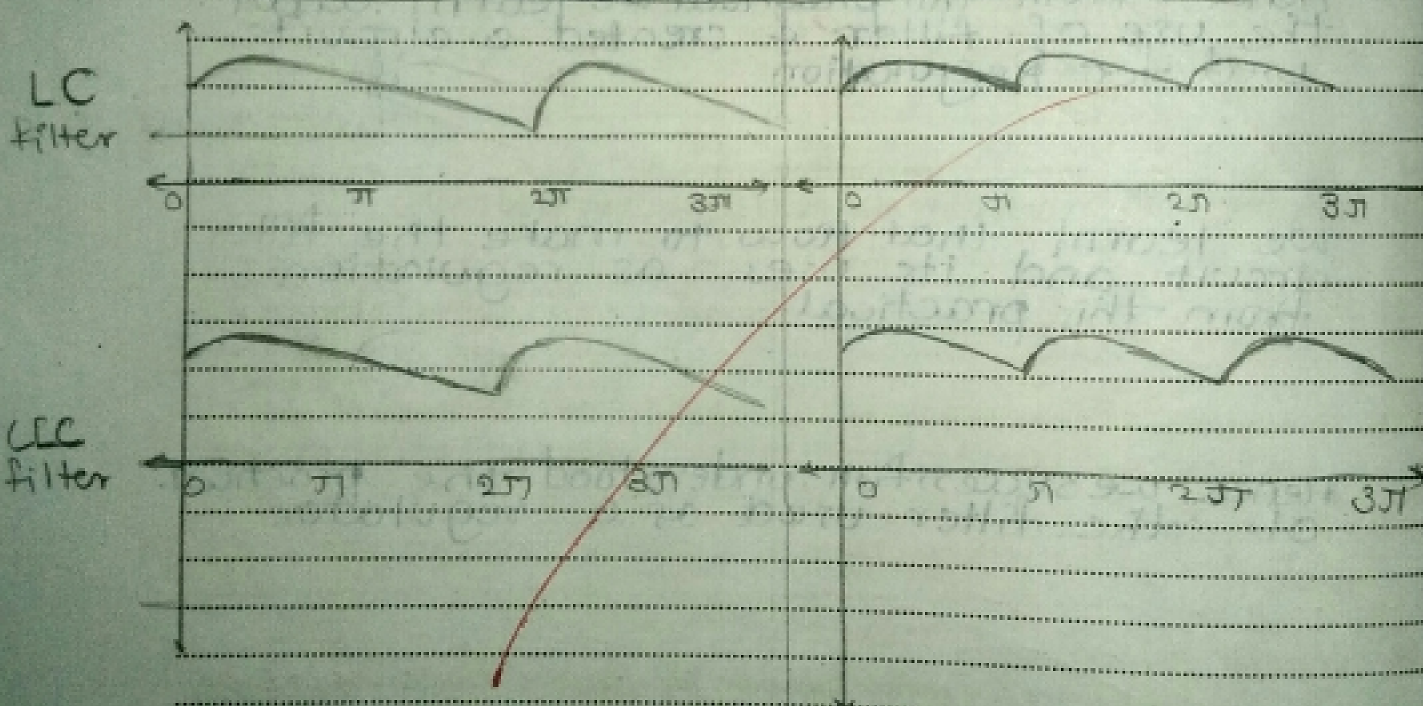
Note: Below given are few sample questions for reference. Teachers <u>must design</u> more such questionsso as to ensure the achievement of identified CO.

1. Repeat the steps to find out DC output for LC and CLC filters for half wave as well as full wave rectifiers.
2. Compare output waveforms of LC and CLC filters for half wave as well as full wave rectifiers.

[Space for answers]

1.) ⇒ We learnt rectifier circuit that converts sinusoidal ac voltage into its corresponding pulsating dc. Adding filter in the rectifier circuit. the filter removes ripples from Rectifier's output waveform and gives the dc, but it is not so pure.
in LC filter the output waveforms is dc but some of the ripples is present in it and in CLC filter also. but the LC filter is mostly used and accpted.
CLC filter is also called as π filter.

Half wave rectifier — full wave rectifier



Practical No. 9: Convert AC Signal into DC Signal through Bridge Rectifier.

I Practical Significance

Half-wave rectifier circuit is unsuitable to applications which need a "steady and smooth" dc supply voltage since only alternate half cycles are rectified. One method to improve on this is to use every half-cycle of the input voltage instead of every other half-cycle. The circuit which allows us to do this is called a full wave rectifier. Here, unidirectional current flows in the output for both the cycles of input signal and rectifies it. In this experiment students will observe the working of full wave Bridge rectifier.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

PO3. Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency '***Use simple electronic circuits of computer system***'

i. Connect Circuits
ii. Record measurements.
iii. Analyze results

IV Relevant Course Outcome(s)

Use diodes in different applications

V Practical Outcome

Convert AC into DC signal through Bridge Rectifier

i. Convert AC signal into DC signal through Bridge rectifier
ii. Identify terminals of the component.
iii. Connect circuit components of Bridge rectifier and label components.
iv. Usefunctions of CRO required for Bridge rectifier
v. Observe performance of full wave Bridge rectifier by Output DC voltage waveform
vi. Compare with half wave rectifier.

VI Relevant Affective domain related Outcome(s)

i. Handle components and instruments carefully.
ii. Work in a team

VII Minimum Theoretical Background

The circuit has four diodes connected to form a bridge. The ac inputvoltage is applied to the diagonally opposite ends of the bridge. The loadresistance is connected between the other two ends of the bridge.

For the positive half cycle of the input ac voltage, diodes D1 and D2 conduct, whereas diodes D3 and D4 remain in the OFF state. The conducting diodes will be in series with the load resistance R_L and hence the load current flows through R_L. For the negative half cycle of the input ac voltage, diodes D3 andD4 conduct whereas, D1 and D2 remain OFF. The conducting diodes D3and D4 will be in series with the load resistance R_L and hence the current flows through R_L in the same direction as in the previous half cycle. Thus abi-directional wave is converted into a unidirectional wave.

VIII Practical Circuit diagram:

(a) Sample

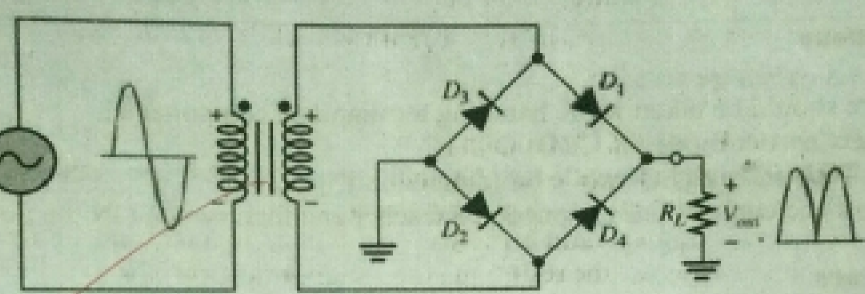
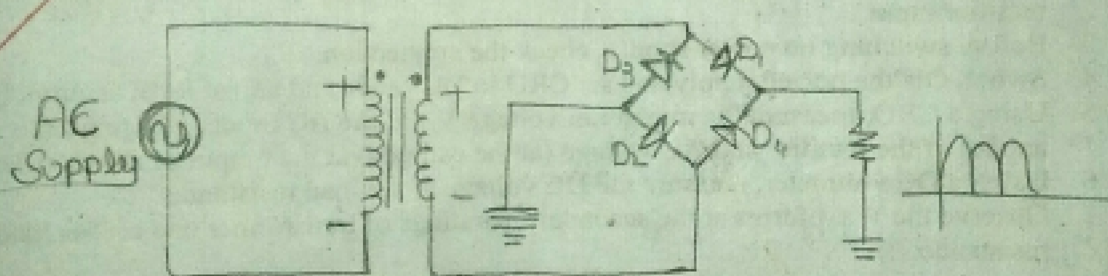
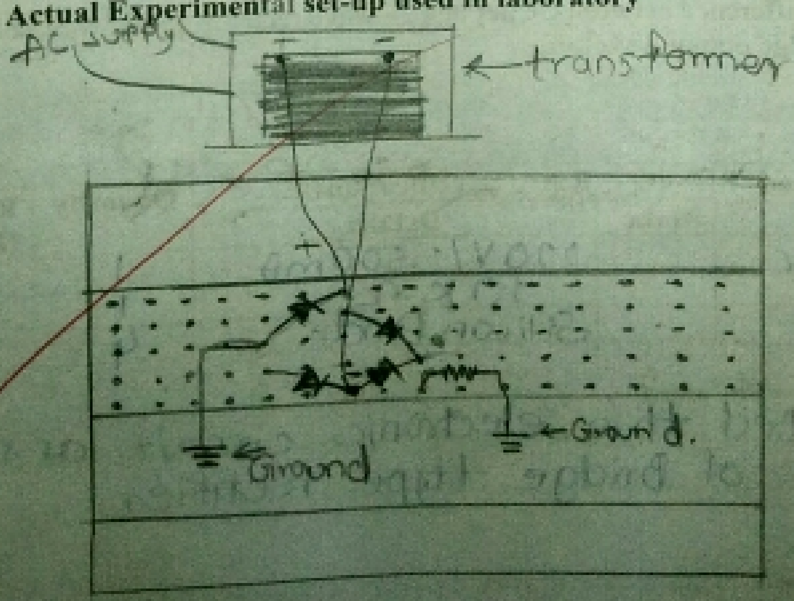


Figure. 1 Bridge Rectifier

(b) Actual Circuit used in laboratory



(c) Actual Experimental set-up used in laboratory



IX Resources required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	Transformer	220V/12V V AC, 500 mA	1 No.
2.	Resistor	10K Ω	1 No.
3.	Diode	Silicon Diode IN4007	4 No.
4.	Digital Multimeter / CRO	3 1/2 digit display/ 0-20 MHz (Dual Trace).	1 No.
5.	Connecting wires	Single Strand	1 No.

X Precautions

1. Care should be taken while handling terminals of components.
2. Select proper mode for CRO.
3. Connect wires tightly while building circuit.
4. Show the connections to concerned teacher and then switch ON the power supply.

XI Procedure

Part I

1. Connect the Electronic circuit for Bridge rectifier on bread board / kit as shown in circuit diagram (Figure 1).
2. Connect the primary side of the transformer to AC mains and the secondary side to rectifier input.
3. Before switching on power supply, check the connection.
4. Switch ON the power supply and set CRO in DC mode and adjust level accurately.
5. Using a CRO, measure the maximum voltage V_m of the AC input voltage (at the anode) of the rectifier and AC voltage (at the cathode) at the output of the rectifier.
6. Using a DC voltmeter, measure the DC voltage at the load resistance.
7. Observe the Waveforms at the secondary windings of transformer and across load resistance.

Part II

1. Observe the input and output waveform on CRO.
2. Observe the difference between Center tapped wave rectifier output waveform and full wave Bridge output waveforms.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	Transformer		220V/. 500mA	1	
2	Resistor		10 K Ω	1	
3	Diode		Silicon Diode.	4	

XIII Actual Procedure Followed

1. Conneted the electronic circuit as shown in
2. figure of Bridge type rectifier.

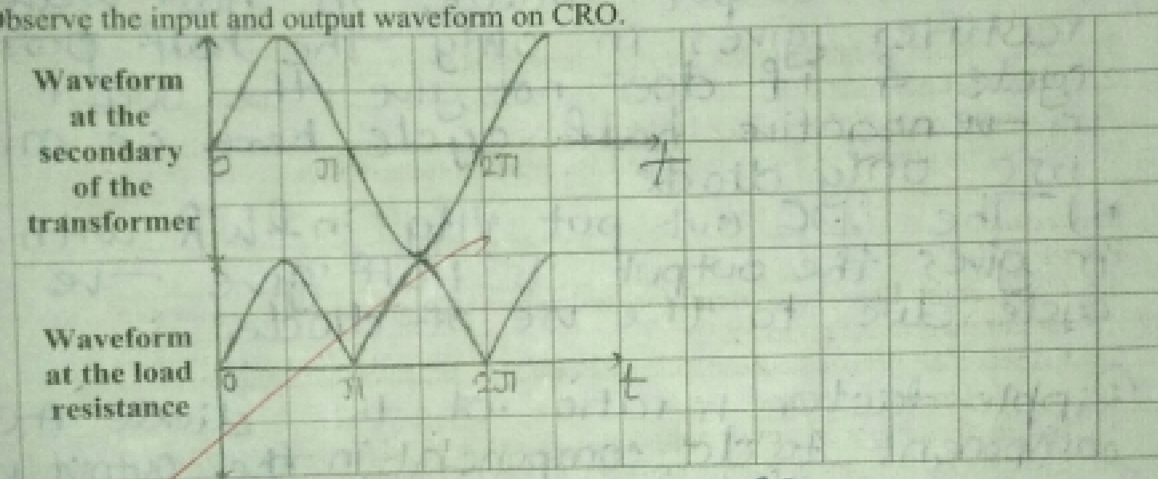
3. we checked the connection, before on
4. the switch.
5. Obsered input and output wave form of
6. CRO. Used DC voltmeter to measure the DC voltage.

XIV Precautions

1. Care should be taken while handling terminals of components. Selected proper mode for CRO

XV Observations and Calculations

Observe the input and output waveform on CRO.



1.Measure the d.c. component in the output(V_{dc})=..7.63. V

where $V_{dc}=\frac{2V_m}{\pi}$

T= 0.04se

f=5 Hz

XVI Results

Vm= calculated=12 V

T= 0.04se

f=5Hz

XVII Interpretation of results (Give meaning of the above obtained results)

We learnt converting AC signal into DC signal trough Bridge Rectifier from this practical

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results).

Hence, we successfuly understood the practical of converting AC to DC signal through Bridge type rectifier.

XIX Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

1. Calculate ripple factor for the circuit.
2. What is the difference in DC output voltage in half wave and full wave rectifier and Bridge for the same AC input?

[Space for answers]

2.) i) The DC output voltage in half wave rectifier gives in only the half positive cycle & it does not give the output in ~~ve~~ negative half cycle. here we can use only diode.

ii) The DC out put vltg in FWR with bridge is gives the output is Half give -ve cycle due to the use of diode.

1) Ripple factor is ratio of the diode AC component to dc component in the output vltg

Practical No.10: Test the Performance of the given Bridge Rectifier Using Filter

I Practical Significance

Half -wave rectifier circuit is unsuitable to applications which need a "steady and smooth" dc supply voltage. One method to improve on this is to use every half-cycle of the input voltage instead of every other half-cycle. The circuit which allows us to do this is called a full wave rectifier. Here, unidirectional current flows in the output for both the half cycles of input signal and rectifies it. In this experiment students will observe the working of full wave Bridge rectifier and determine DC voltage with and without the use of filters.

II Relevant Program Outcomes (POs)

PO1. Basic knowledge: An ability to apply knowledge of basic mathematics, science and engineering to solve engineering problems.

PO2. Discipline knowledge: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

PO3. Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

PO4.Engineering Tools: Apply relevant technologies and tools with an understanding of the limitations.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency '*Use simple electronic circuits of computer system*'

i. Connect Circuits
ii. Record measurements.
iii. Analyze results

IV Relevant Course Outcome(s)

Use diodes in different applications

V Practical Outcome

Test the performance of the given Bridge rectifier using filter.

- Identify terminals of the component.
- Mount circuit components of Bridge wave rectifier.
- Observe functions of CRO required for Bridge wave rectifier
- Observe performance of Bridge wave rectifier by Output DC voltage waveform
- Observe performance of Bridge wave rectifier with filter and without filter.
- Compare with Bridge wave rectifier with filter and without filter.

VI Relevant Affective domain related Outcome(s):

i. Handle components and instruments with care.
ii. Work in a team
iii. Make aesthetically neat connections.

VII Minimum Theoretical Background

The filtered full wave rectifier is created from the Bridge rectifier by adding a capacitor across the output. The result of the addition of a capacitor is a smoothing of the FWR output. The output is now a pulsating dc, with a peak to peak variation called ripple. The magnitude of the ripple depends on the input voltage magnitude and frequency, the filter capacitance, and the load resistance.

The circuit diagram of the bridge rectifier with filter capacitor is shown in the following figure 1. The smoothing capacitor converts the full-wave rippled output of the rectifier into a smooth dc output voltage.
When capacitor charges during the first cycle, surge current flows because initially capacitor acts like a short circuit. Thus, surge current is very large. If surge current exceeds rated current capacity of the diode it can damage the diode. To limit surge current surge resistance is used in series as shown in the figure. Similar surge resistance can be used in half wave as well as center-tapped full wave rectifier also.
Two important parameters to consider when choosing a suitable a capacitor are its working voltage, which must be higher than the no-load output value of the rectifier and its capacitance value, which determines the amount of ripple that will appear superimposed on top of the dc voltage.

Apart from rectification efficiency, the main advantages of a full-wave bridge rectifieris that it has a smaller ac ripple value for a given load and a smaller smoothing capacitor than an equivalent half-wave rectifier. The amount of ripple voltage that is superimposed on top of the dc supply voltage by the diodes can be virtually eliminated by adding other improved filters such as a pi-filter.

VIII Practical Circuit diagram:

(a) Sample

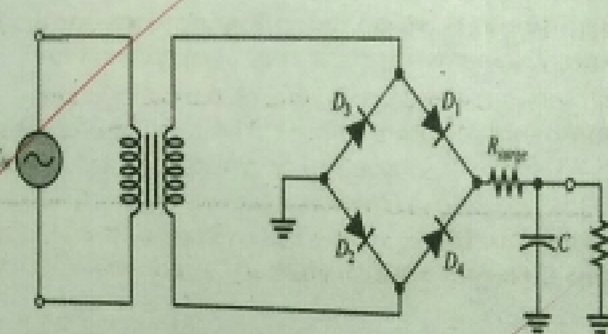
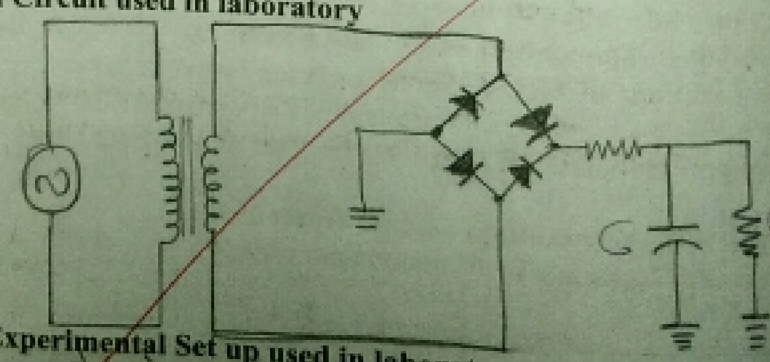
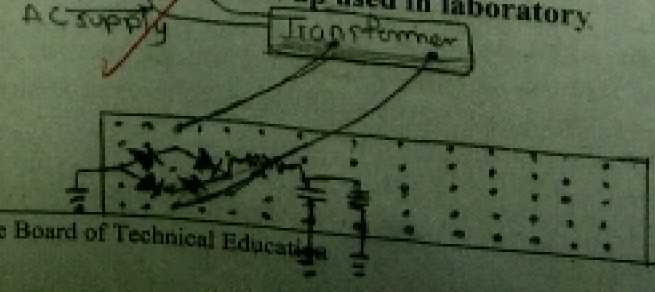


Figure No. 1 Bridge Rectifier with Capacitive filter

(b) Actual Circuit used in laboratory



(c) Actual Experimental Set up used in laboratory



IX Resources required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	Transformer	220V/12 V AC, 500 mA	1 No.
2.	Resistor	10K Ω	1 No.
3.	Diode	Silicon D1N4007	4 No.
4.	Digital Multimeter / LCR-Q meter / CRO	3 1/2 digit display.	1 No.
5.	Connecting wires	Single Strand	1 No.
6.	Capacitor	10µF/100µF	1

X Precautions

1. Care should be taken while handling terminals of components.
2. Select proper mode for CRO.
3. Connect wires tightly while building circuit.
4. Show the connections to concerned teacher and then switch ON the power supply.

XI Procedure

Part I

1. Connect the electronic circuit for Bridge rectifier with filter on bread board / kit as shown in circuit diagram.
2. Connect the primary side of the transformer to AC mains and the secondary side to rectifier input.
3. Before switching on power supply, check the connection.
4. Switch ON the power supply and set CRO in DC mode adjust level accurately.
5. Using a CRO, measure the maximum voltage V_m of the AC input voltage (at the anode) of the rectifier and AC voltage (at the cathode) at the output of the rectifier.
6. Using a DC voltmeter, measure the DC voltage at the load resistance.
7. Observe the Waveforms at the secondary windings of transformer and across load resistance.

Part II

1. Observe the input and output waveform on CRO.
2. Observe the difference between Center tapped wave rectifier output waveform and full wave Bridge output waveforms.
3. Observe the difference between Center tapped wave rectifier with filter output waveform and full wave Bridge rectifier with output waveforms.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.	Transformer		220V/12VAC		
2.	Resistor		10K Ω		
3.	Diode.		Silicon Diode		

XIII Actual Procedure Followed

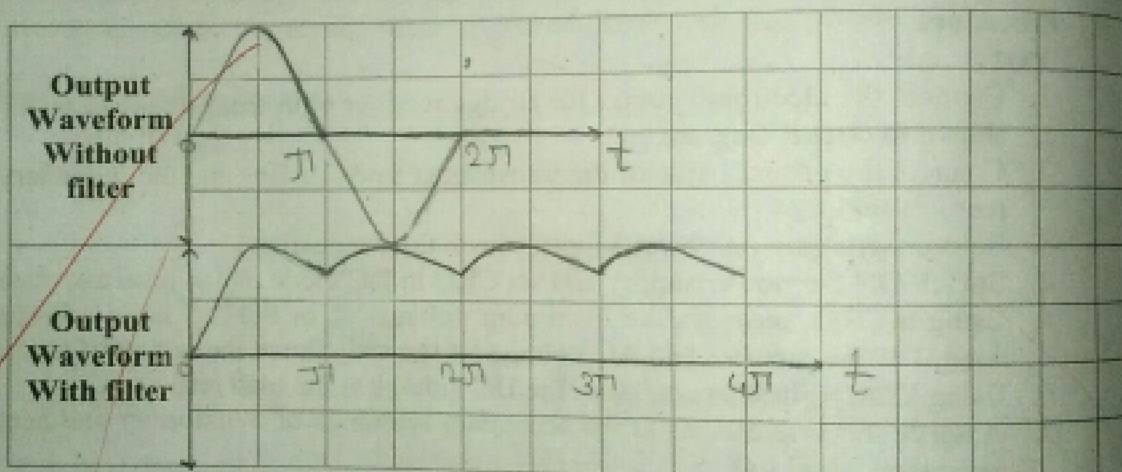
1. Con~~nected~~ the electronic circuit for bridge
2. rectifier with filter on bread-bord
3. connected the primary side of the transform
4. to AC mains and the secondary side
5. to rectifier input.
6. using CRO probe measured the waves Vm.

XIV Precautions

1. We took care while handaling the
2. terminals. selected probe mode for CRO
3. connected wires tightly

XV Observations and Calculations

1. Observe the input and output waveform on CRO.



2. Measure the d.c. component in the output(V_{dc})=………… V(without filter)
3. Measure the d.c. component in the output(V_{dc})=..0.19.. V(with filter)
4. Theoretically calculate Vdc with and without filter using the formula $V_{dc}=\frac{2V_m}{\pi}$

XVI Results

We find out the heading of waveform

XVII Interpretation of result (Give meaning of the above obtained results)

We seen the diffrence let the output of using filter output of the circuit without using filter.

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results).

We calculate the dc output of filter used in the circuit & also we calculated the dc output though using filter in circuit.

XIX Practical related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

1. List applications of Full wave bridge rectifier.
2. What is the frequency of AC component at the output of Bridge rectifier? Give reason.
3. What is the difference in DC output voltage in half wave and full wave bridge rectifier with filter and withoutfilter for the same AC input?

[Space for answers]

1) i) It is used to detect the amplitude of the modulating radio signal.
ii) It is also used to supply steady pluamzed DC vltg in electric welding.

2) → The frequency of AC component of the output of bridge rectifier is 50Hz. because we give the input is DC current getting the output as pulsating DC current therefore the frequency is 50Hz remain input and output same frequency.

3) ⇒ FWR provide almost twice the DC output voltage as compaired to HWR if we use the filter in circuit then we does not use rectifier in circuit then the output is pulsating dc.

Practical No. 14: Determine Gain and Bandwidth of Single Stage RC Coupled Amplifier

I Practical Significance

Common emitter amplifiers are used to increase the strength of a weak AC signal. They provide high voltage gain, current gain and moderate. Power gain: It has low input impedance and output impedance. These amplifiers are used in communication transmitters and receivers.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: Apply basicelectronics engineering knowledge to solve broad-basedComputerengineering related problems.

PO3. Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Computer engineering problems.

PO4. Engineering tools: Apply relevant technologies and tools with an understanding of the limitations.

PO10. Life- long learning: Engagein independent and life-long learning activities in the context of technological changes in the Computer Engineeringfield and allied industry.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency ***'Use simple electronic circuits of computer system'***

i. Connect circuits with voltage sources and measuring instruments.
ii. Record measurements.
iii. Analyze the observations

IV Relevant Course Outcome(s)

Interpret the working of BJT in Electronic Circuits.

V Practical Outcome

Determine gain and bandwidth of single stage RC coupled amplifier:

- Make Connections as per required circuit diagram.
- Measure voltage and currents at various terminals.
- Plot the frequency versus Gain response.
- Calculate the cut off frequencies, Bandwidth and calculate its gain.

VI Relevant Affective domain related Outcome(s)

i. Handle components and instruments carefully.
ii. Make connections in an orderly manner

VII Minimum Theoretical Background

An amplifier is an electronic circuit that can increase the strength of a weak input signal without distorting its shape. The CE configuration is widely used as a basic amplifier as its both voltage and current amplification with 180^0 phase shift. The factor by which the input signal gets multiplied after passing through the amplifier is called the gain of the amplifier

It is given by,

Gain= Output voltage/Input voltage

Practical No. 14: Determine Gain and Bandwidth of Single Stage RC Coupled Amplifier

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It is given by,

Gain= Output voltage/Input voltage

The resistance R_1& R_2 provide the necessary bias condition and ensure that emitter base junction is operating in the active region. The Q point is placed at the middle of the DC load line. This will ensure that there is no clipping or distortion of the input signal.

VIII Practical Circuit Diagram

(a) Sample

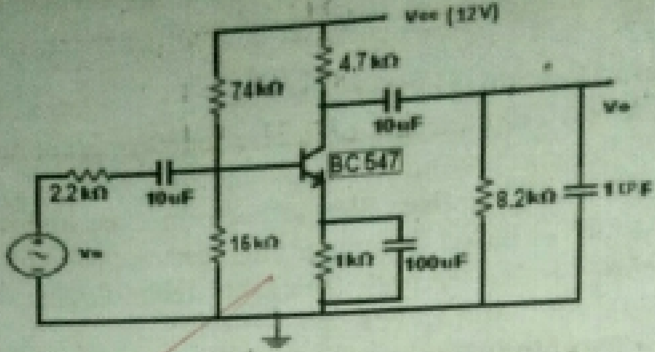
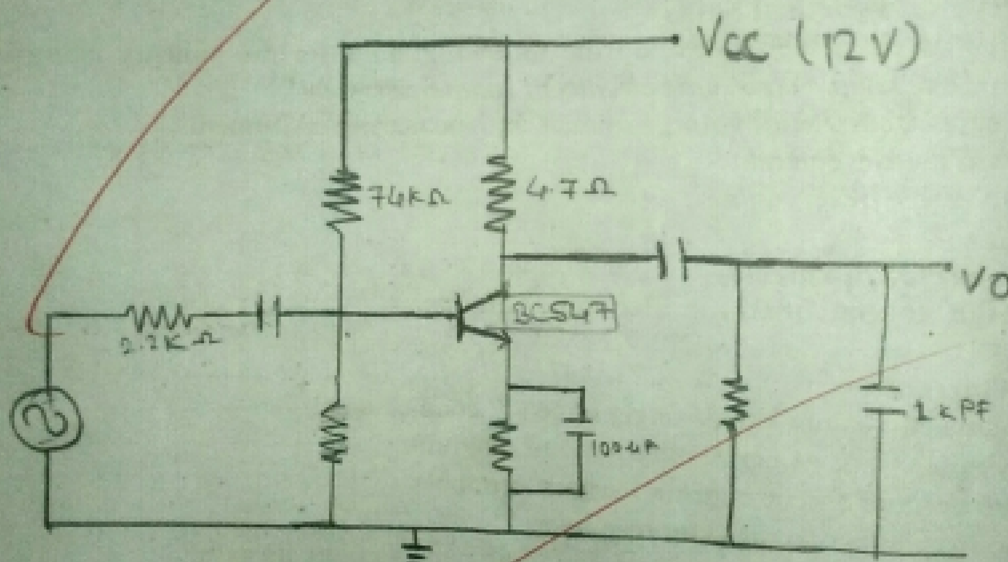
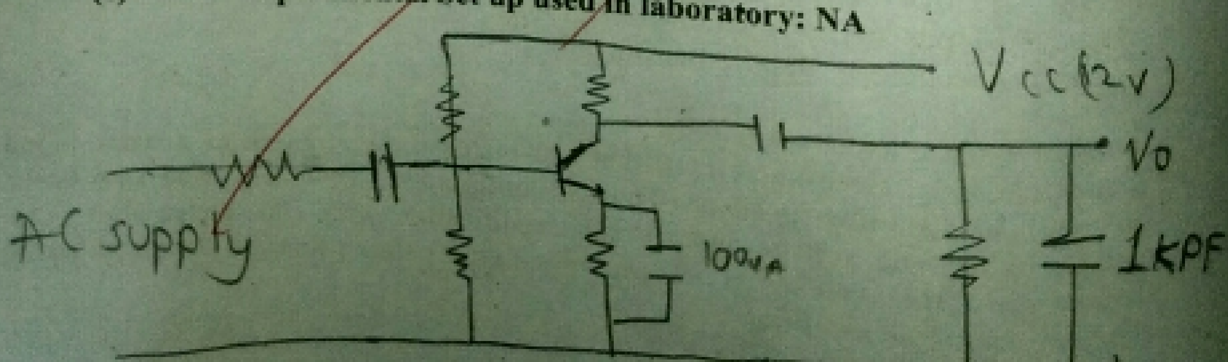


Figure 1: Single Stage RC Coupled Amplifier

(b) Actual Circuit used in laboratory



(c) Actual Experimental Set up used in laboratory: NA



IX Resources Required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	DC Regulated Power supply	Variable DC power supply 0-30V,2A display for current & voltage	1 No.
2.	Function Generator	0-1 MHz	01
3.	Transistor	BC 547	01
4.	Resistor	R_1-74KΩ, R_2-15KΩ , 2.2 KΩ, 4.7KΩ, 1KΩ, 8.2 KΩ	01 Each
5.	Capacitors	As per circuit diagram	01
6.	Connecting Wires		

X Precautions

1. Carefully handle the terminals of the components do not exceed the ratings of the transistor because this may damage the transistor.
2. Select proper range of time/division and volts/division on CRO.
3. Show the connection to the teacher before switching the power supply ON

XI Procedure

1. Connect the circuit as the circuit as shown in the figure. Set source voltage as $50mV_{p-p}$at 1 kHz frequency using function generator/signal generator.
2. Keep the input voltage as constant. Vary the frequency from 50 Hz to 1MHz in regular steps and note down the corresponding p-p output voltage on CRO.
3. Plot the graph for frequency versus gain in (dB) in a semi-log graph sheet.
4. Calculate the bandwidth from the graph.

XII Resources Used

S. No	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	DC Regulated		DC power supply.	1	
2	Transistor		BC 547	2	
3	Resistor		74kΩ, 15kΩ.	2	

XIII Actual Procedure Followed (use blank sheet provided if space not sufficient)

1. Connected ~~hen~~ the circuit as the circuit as
2. shown in the figure. set the source voltage.
3. keep proper range of time/division
4. Plotted the graph for frequency versus
5. gain in (dB) in a semi-log graph sheet.
6. calculated the bandwidth from the graph.

XIV Precautions

1. Carefully handle the terminals of the
2. components do not exceed the rating of the diode

XV Observations and Calculations(use blank sheet provided if space not sufficient)

1. Input Voltage V_s at 1 kHz= 1 V
2. Supply Voltage V_{cc}= 230 V 50Hz

Table: 1

Sr. No	Frequency	V_O (V)	Gain V_O/V_s	Gain in dB= 20 $\log_{10} V_O/V_s$
1)	100Hz	1V, 100Hz	1.8	0.25
2)	1K	1V, 110Hz	1.8	0.25
3)	10k	1V, 10kHz	2.6	0.41
4)	100k	1V, 100Hz	1	0.

Graph:

Plot the graph on a semi log sheet with frequency on the X axis and Gain (dB) on Y axis. Mid band frequency range is defined as those frequencies at which the response has fallen to 3dB below the maximum gain.(|A| max). These are shown as F_L& F_H and are called as the 3 dB frequencies or the cut off frequencies respectively. The difference between F_L& F_H is referred to as the bandwidth (F_H- F_L)

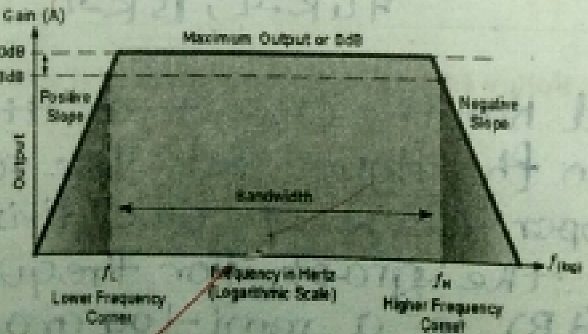


Figure 2: Frequency Response

XVI Results

1. Lower cutoff frequency F_L= ....10 Hz..........
2. Higher cutoff frequency F_H = ...100 kHz..........
3. Bandwidth (F_H -F_L) = ...9.990 Hz..........

XVII Interpretation of Results (Give meaning of the above obtained results)

We determined the Bandwidth of single stage RC & calculated the Bandwidth and higher cuttoff frequency.

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results).

Hence, we successfully understood the Bandwidth of single stage RC coupled Amplifier.

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

1. What is the gain of the amplifier when the input frequency is 1 kHz, 1 MHz?
2. How much is the Base Emitter Voltage (V_{BE}) of the transistor?

[Space for answers]

1) → For 1 kHz

= A x BW = 1000 x 10,00 Hz

= 1000,00

1 kHz = 0.25

1 MHz = 0

GBP = A x BW x 10 x 1000 00 Hz =

= 1000,000

The out put frequency is 2 kHz which is amplified.

2) ⇒ 0.7 V being the voltage drop of a forward biased P-N junction. There is some base - emmitter or n V.

Practical No.15: Determine Gain and Bandwidth of 2-Stage RC Coupled Amplifier.

I Practical Significance

Single amplifier circuits, such as CE,CB & CC amplifiers are seldom found alone, as a single stage amplifier in any system. At least two or more than two stages are connected in cascade combination. The benefit of cascaded amplifier is to develop a larger output than the individual stages alone can develop. The individual stage gains are set relatively low to reduce signal distortion. RC coupling has the advantage of wide frequency response. The student will be able to plot the frequency response of the amplifier and calculate bandwidth.

II Relevant Program Outcomes (POs)

PO2. Discipline knowledge: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

PO3. Experiments and practice: An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

PO4.Engineering Tools: Apply relevant technologies and tools with an understanding of the limitations.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency '***Use Simple electronic circuits of electronics Circuits***'

i. Connect Circuits with Voltage sources and measuring instruments.
ii. Record measurements.
iii. Analyze the observations.

IV Relevant Course Outcome(s)

- Interpret the working of BJT in electronic circuits.

V Practical Outcomes

Determine gain and bandwidth of 2 Stage RC Coupled Amplifier.

- Make necessary connection.
- Measure Voltages and Currents at various terminals.
- Plot the frequency response.
- Calculate the cutoff frequencies, Bandwidth and gain.

VI Relevant Affective domain related outcome(s):

i. Handle Electronic equipments and components carefully
ii. Work in team

VII Minimum Theoretical Background

When an ac signal is applied to the base of the first transistor, it is amplified and developed across the output of the 1st stage. This amplified voltage is applied to the base of next stage of amplifier and reappears across the output of the second stage. Successive stages amplify the signal and the overall gain is raised to the desired level. RC Coupled amplifier is the most popular coupling since it is cheap and provides a constant amplification over a wide range of frequencies.

VIII Practical Circuit diagram

(a) Sample

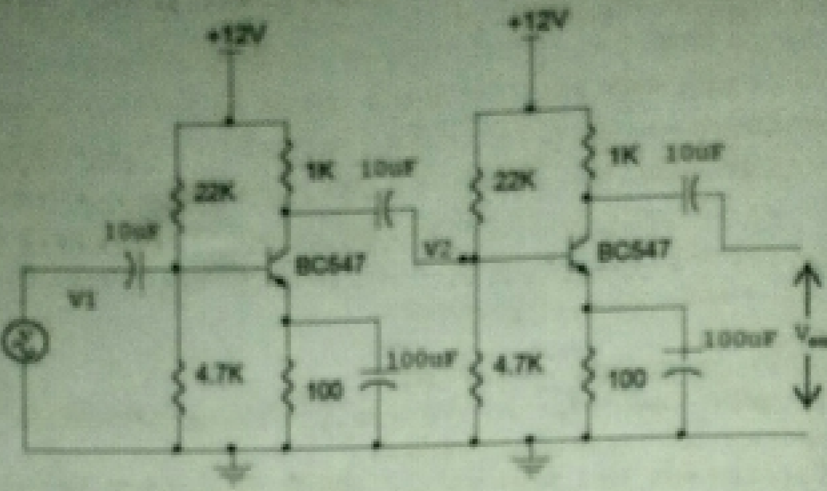
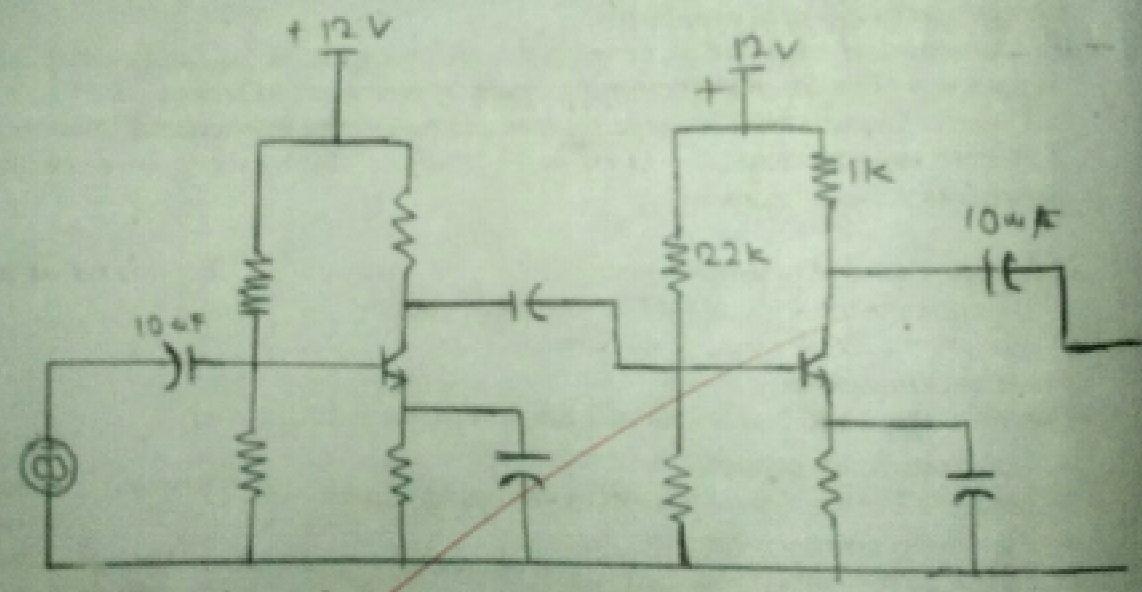
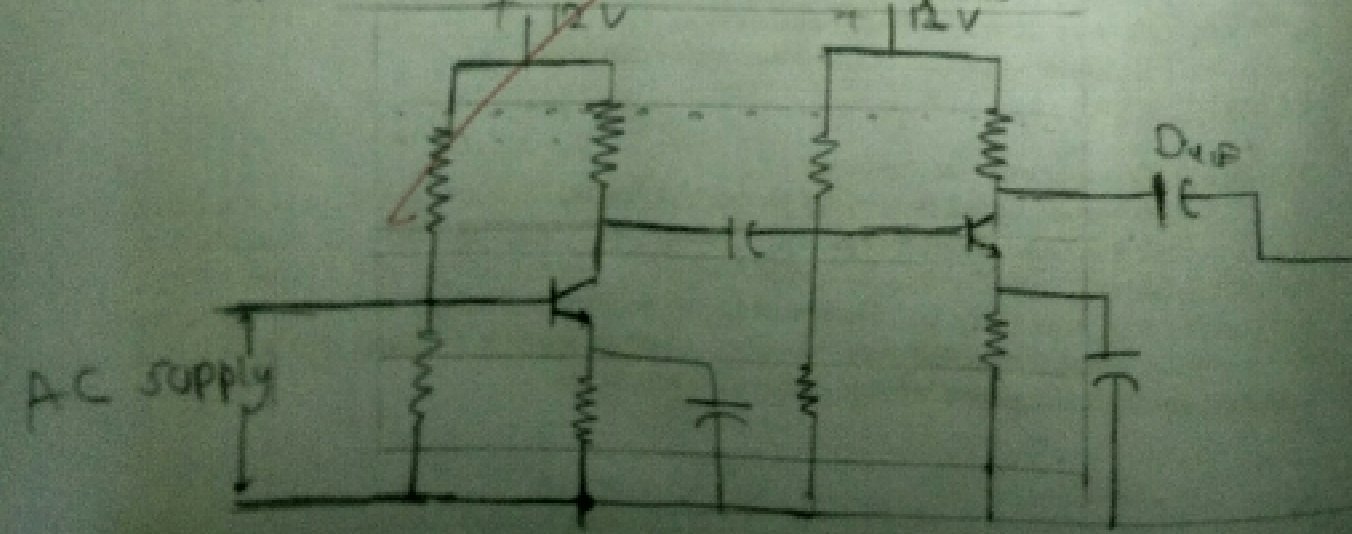


Figure1: 2 Stage RC coupled Amplifier

(b) Actual Circuit used in Lab.



(c)Actual Experimental setup used in Laboratory: NA



XIX Resources Required

S. No.	Name of Resource	Suggested Specification	Quantity
1.	Dual DC power supply	0-30 V Variable	1 No.
2.	Signal Generator	0-1 MHz	1 No.
3.	DMM (Voltmeter)	0-20 V	1 No.
4.	Transistor	BC 547	2 No.
5.	Resistors	22KΩ, 4.7 KΩ, 1KΩ	2 No. each
6.	Capacitors	10μF, 100 μF	2 No. each

X Precautions

1. Before connecting the input to the circuit, the input V is to measured and it should be less than 0.1 V.
2. The input voltage should be maintained at constant value throughout the experiment.
3. Select proper range of DMM for measurement of Voltage.
4. The connections are to be shown to the teacher before switching the power supply 'ON'.

XI Procedure

1. Connect the circuit as shown in the figure. Set source Voltage to 0.05v (50mV) at 500 Hz frequency. Keep this input Voltage constant throughout the experiment.
2. Set the input frequency at 100 Hz and vary upto 1 MHz in regular steps and note down the output voltage.
3. Calculate gain of the amplifier for each frequency.
4. Plot the graph between frequency (X-axis) and the gain in (dB) (Y-axis) in a semi-log graph sheet.
5. Calculate the Bandwidth from the graph.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1	Dual DC ~~ps~~		0-30 V Variable	1	
2	DMM (Voltmeter)		0 - 20 V.	1.	
3	Transistor		BC 547	2.	

XIII Actual Procedure Followed (use blank sheet provided if space not sufficient)

1. Connected the circuit as shown. Set source
2. voltage to 0.05v (50mV) at 500Hz frequency
3. Keept this input voltage constant throughou
4. the experiment.
5. set the input frequency at 100Hz and
varied it.

XIV Precautions

1. We checked the connection before on the
2. switch and check the connections.

XV Observations and Calculations (use blank sheet provided if space not sufficient)

Input Voltage V_{in} = 1 V

Supply Voltage = 12 V

S. No	Frequency (f) Hz	Output Voltage(V)	Gain (V_0/V_{in})	Gain in db= 20 log $_{10}V_o$/Vin
1	10 ~~kHz~~	1V, 10 Hz	4.4 V	12.8
2	100 Hz	1V, 100Hz	6.4 V	12.8
3	1k Hz	1V, 1k	~~5.2V~~ 4.4 V	12.8
4	10 kHz	1V, 10k	5.2 V	17.
5	100kHz	1V, 100k	2.2 V	6.02

Graph:

Plot the graph on a semi log sheet with frequency on the X axis and Gain (dB) on Y axis. Mid band frequency range is defined as those frequencies at which the response has fallen to 3dB below the maximum gain (|A| max). These are shown as F_L & F_H and are called as the 3 dB frequencies or the cut off frequencies respectively. The difference between F_L & F_H is referred to as the bandwidth (F_H- F_L)

XVI Results

1. Lower Cut off frequency F_L = 10 Hz
2. Higher Cutoff frequency F_H = 100 KHz
3. Bandwidth $F_H - F_L$ = 0990 Hz
4. Gain of the amplifier =

XVII Interpretation of Results (Give meaning of the above obtained results)

We determine the Gain and Bandwidth of 2-stage RC coupled Amplifier from this practical & learnt about it.

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results).

Hence, we successfull done the practical about Determining the Gain & Bandwidth of 2-stage RC coupled Amplifier,

XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers <u>must design</u> more such questionsso as to ensure the achievement of identified CO.

1. What is the gain of the amplifier's 1st stage?
2. What is the maximum input that can be given to the amplifier that has been built?

[Space for answers]

1) ⇒ 0.25 is the gain of amplifier in 1st stage

2) The maximum input that can be given to the amplified has been built is 12V.

Practical No.18: Test the Performance of the Given Circuit Consisting of Photoelectric Sensor

I Practical Significance:

In industry, photodiodes involve in applications similar to photo detectors like charge-coupled devices, photoconductors, and photomultiplier tubes. These diodes are used in consumer electronics devices like smoke detectors, compact disc players, and televisions and remote controls in VCRs. Photodiodes are frequently used for exact measurement of the intensity of light in science & industry. Generally, they have an enhanced, more linear response than photoconductors. Photodiodes are also widely used in numerous medical applications like instruments to analyze samples, detectors for computed tomography and also used in blood gas monitors.

These diodes are much faster & more complex than normal PN junction diodes and hence are frequently used for lighting regulation and in optical communications. The students will be able to plot the VI characteristics of the given photodiode

II Relevant Program Outcomes (POs)

PO2.Discipline knowledge: Apply basic electronics engineering knowledge to solve broad-based Computer engineering related problems.

PO3.Experiments and practice: Plan to perform experiments and practices to use the results to solve broad-based Computer engineering problems.

PO4.Engineering tools: Apply relevant technologies and tools with an understanding of the limitations.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency '***Use simple electronic circuits of computer system***':

i. Connect circuits.
ii. Record Measurements.
iii. Analyze Circuits.

IV Relevant Course Outcomes

- Use sensors and transducers

V Practical Outcome

Test the performance of the given circuit consisting of photoelectric sensor

- Measure photo current of a given diode.
- Measure Dark current of a given diode.

VI Relevant Affective domain related outcome(s):

i. Handle Electronic equipments and components carefully
ii. Work in team.

VII Minimum Theoretical Background

A photodiode is a two terminal PN-junction diode that consumes light energy to produce electric current. It is also called as photo-detector, a light detector, and photo-sensor. These diodes are designed to work in **reverse bias** condition, it means that the

VIII Practical Circuit Diagram

(a) Sample

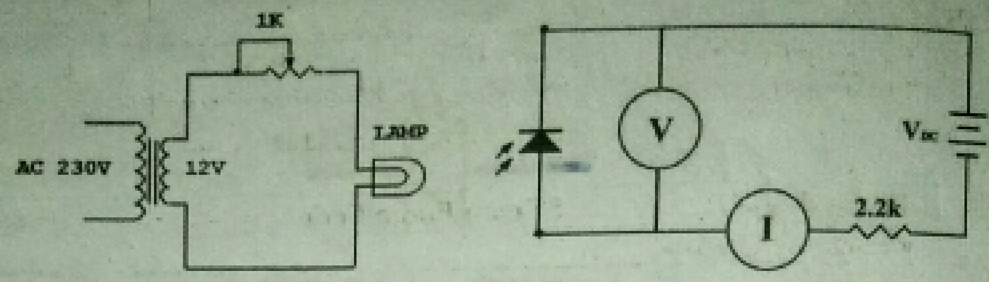
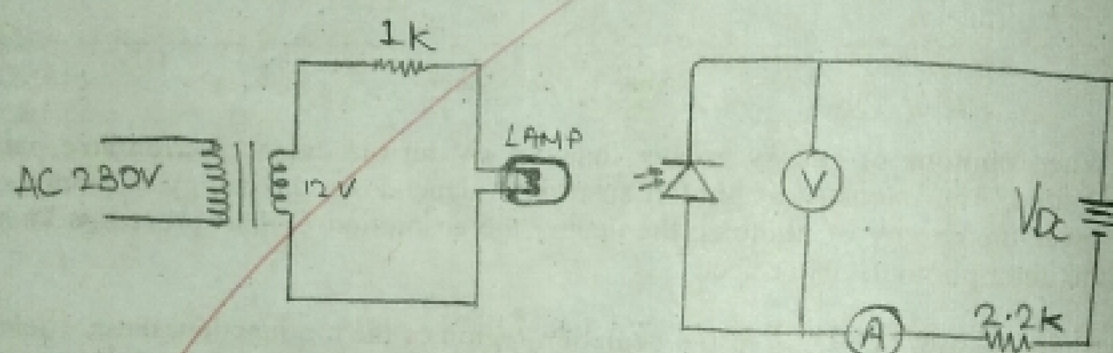
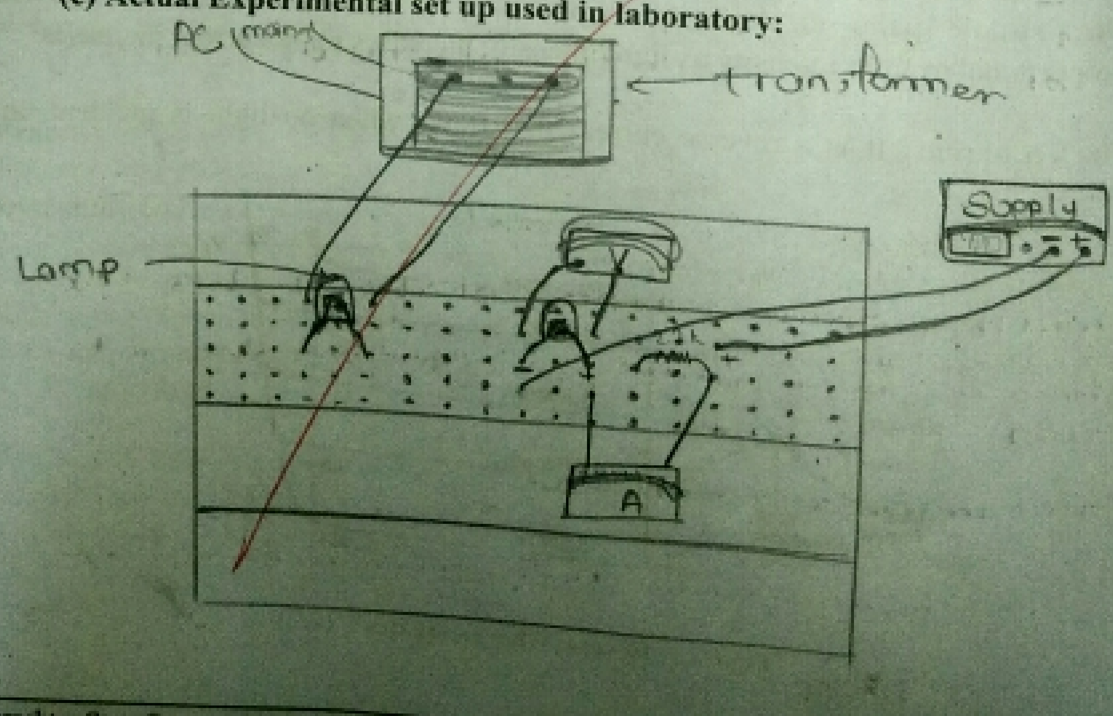


Figure 4: Circuit diagram of Photo diode in Reverse bias

(b) Actual Circuit used in laboratory



(c) Actual Experimental set up used in laboratory:



XIII Actual procedure followed

Selected the component as shown in fig. created the circuit. Applied the reverse voltage to diode changed the light source & repeated the steps.

XIV Precautions

We not op the power supply unless & untill the connections are checked
While doing the experiment we not exceed the voltage of diode beyound the rated voltage conected voltmeter ammeter in the correct polarities.

XV Observations and Calculations:

Table 1: Measurement of Photodiode current

Light Intensity	Position I No light Condition		Position II Low Light Condition		Position III Medium Light Condition		Position IV High Light condition	
SR No.	V_R Volts	I_R (µA)	V_R Volts	I_R (µA)	V_R Volts	I_R (µA)	V_R Volts	I_R (µA)
1	2	0.21	2	0.26			2	0.40
2	4	0.28	4	0.34			4	0.48
3	6	0.34	6	0.39			6	0.57
4	8	0.40	8	0.46			8	0.65
5	10	0.49	10	0.53			10	0.74
6	12	0.55	12	0.59			12	0.80
7	14	0.62	14	0.66			14	0.88
8	16	0.67	16	0.75			16	0.96

XXII Results

Dark Current: 0.10 A

XVII Interpretation of results (Give meaning of the above obtained results)

We calculated the dark current position of the source light of lamp and increase the length of the source and calculated it.

XVIII Conclusions (Actions/decisions to be taken based on the interpretation of results).

We calculated the dark current and increased the reverse voltage and calculated it of photodiode current and voltage.

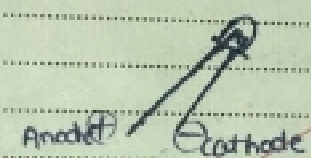
XIX Practical Related Questions

Note: Below given are few sample questions for reference. Teachers must design more such questionsso as to ensure the achievement of identified CO.

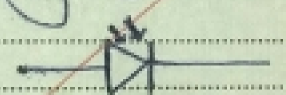
1. Identify anode and cathode of a Photodiode.
2. Draw Symbol of Photodiode.
3. Define Dark current of photodiode.
4. Write application of Photodiode.
5. State operating Principle of photodiode.

[Space for answers]

1)⇒ The bigger wire is the anode(+) & the smaller terminal is cathode(−).



2)⇒ The symbol of photo diode is:



3)⇒ It is the relatively small electric current that flows through photo sensitive devices such as a photomultiplier tube, photodiode or charge-coupled device even when no photons are entering the device, it consist of the charges generated in the detector when no outside radiation is entering the detector.

4)⇒ Applications:-

1) disc players.
2) smoke detectors
3) medical devices
4) and the receivers for infrared(IR)

A photo is also called as p-n junction diode when sufficient energy strikes the diode, it creates an electron hole pair to move. Thus hole move toward the anode, and electrons toward the cathode, and a photocurrent is produced.

XX References / Suggestions for further Reading

S. No.	Title of Book / Website	Author	Publication
1	Applied Electronics	R.S.Sedha	S.Chand and Co.,New Delhi 2008,ISBN 978-8121927833
2	Principles of Electronics	V.K.Mehta	S.Chand and Co., Ram Nagar ,New Delhi-110055,11th Edition,2014.ISBN 978812192405
3	Web Reference		1. https://www.youtube.com/watch?v=SFc673lEyQA 2. https://www.youtube.com/watch?v=yMmXHg0hRok 3. https://www.youtube.com/watch?v=BtQ7qY-uqs8 4. https://www.electronics-notes.com/articles/electronic_components/diode/photodiode-detector-technology.php 5. http://silas.psfc.mit.edu/22.071j/photodiode.pdf http://www.osioptoelectronics.com/application-notes/an-photodiode-parameters-characteristics.pdf