I

Name _____

Roll No. _____ Year 20____ 20____

Exam Seat No. _____

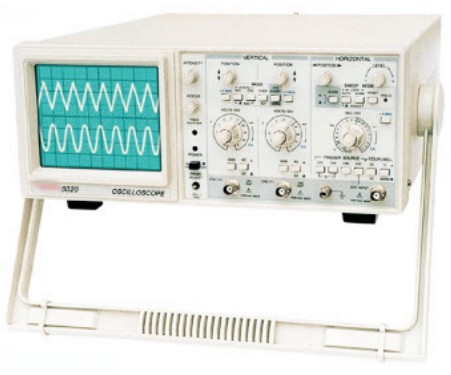
ELECTRICAL GROUP | SEMESTER - II | DIPLOMA IN ENGINEERING AND TECHNOLOGY

A LABORATORY MANUAL

FOR

ELEMENTS OF ELECTRONICS

(22213)



MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

(Autonomous) (ISO 9001 : 2015) (ISO / IEC 27001 : 2013)

VISION

To ensure that the Diploma level Technical Education constantly matches the latest requirements of technology and industry and includes the all-round personal development of students including social concerns and to become globally competitive, technology led organization.

MISSION

To provide high quality technical and managerial manpower, information and consultancy services to the industry and community to enable the industry and community to face the changing technological and environmental challenges.

QUALITY POLICY

We, at MSBTE are committed to offer the best in class academic services to the students and institutes to enhance the delight of industry and society. This will be achieved through continual improvement in management practices adopted in the process of curriculum design, development, implementation, evaluation and monitoring system along with adequate faculty development programmes.

CORE VALUES

MSBTE believes in the followings:

- Education industry produces live products.
- Market requirements do not wait for curriculum changes.
- Question paper is the reflector of academic standards of educational organization.
- Well designed curriculum needs effective implementation too.
- Competency based curriculum is the backbone of need based program.
- Technical skills do need support of life skills.
- Best teachers are the national assets.
- Effective teaching learning process is impossible without learning resources.

A Laboratory Manual for

Elements of Electronics

(22213)

Semester-II

(EE/EP/EU)

Maharashtra State
Board of Technical Education, Mumbai
(Autonomous) (ISO 9001:2015) (ISO/IEC 27001:2013)

Maharashtra State Board of Technical Education,
(Autonomous) (ISO 9001 : 2015) (ISO/IEC 27001 : 2013)
4th Floor, Government Polytechnic Building, 49, Kherwadi,
Bandra (East), Mumbai - 400051.
(Printed on December, 2017)

MAHARASHTRA STATE

BOARD OF TECHNICAL EDUCATION

Certificate

This is to certify that Mr. / Ms. …… Roll No. ……., of First Semester of Diploma in…….. …… of Institute,……..…….. …… (Code: ……...) has completed the term work satisfactorily in Subject **Elements of Electronic Engineering (22213)** for the academic year 20…….. to 20…….. as prescribed in the curriculum.

Place: …… Enrollment No:.……

Date: …… Exam. Seat No: ……

Subject Teacher **Head of the Department** **Principal**

Seal of Institution

Preface

The primary focus of any engineering laboratory/field work in the technical education system is to develop the much needed industry relevant competencies and skills. With this in view, MSBTE embarked on this innovative 'I' Scheme curricula for engineering diploma programmes with outcome-based education as the focus and accordingly, relatively large amount of time is allotted for the practical work. This displays the great importance of laboratory work making each teacher; instructor and student to realize that every minute of the laboratory time need to be effectively utilized to develop these outcomes, rather than doing other mundane activities. Therefore, for the successful implementation of this outcome-based curriculum, every practical has been designed to serve as a 'vehicle' to develop this industry identified competency in every student. The practical skills are difficult to develop through 'chalk and duster' activity in the classroom situation. Accordingly, the 'I' scheme laboratory manual development team designed the practical to focus on the outcomes, rather than the traditional age old practice of conducting practical to 'verify the theory' (which may become a byproduct along the way).

This laboratory manual is designed to help all stakeholders, especially the students, teachers and instructors to develop in the student the pre-determined outcomes. It is expected from each student that at least a day in advance, they have to thoroughly read through the concerned practical procedure that they will do the next day and understand the minimum theoretical background associated with the practical. Every practical in this manual begins by identifying the competency, industry relevant skills, course outcomes and practical outcomes which serve as a key focal point for doing the practical. The students will then become aware about the skills they will achieve through procedure shown there and necessary precautions to be taken, which will help them to apply in solving real-world problems in their professional life.

This manual also provides guidelines to teachers and instructors to effectively facilitate student-centered lab activities through each practical exercise by arranging and managing necessary resources in order that the students follow the procedures and precautions systematically ensuring the achievement of outcomes in the students.

Elements of Electronics course provides a platform for students to understand working of active components such as Diode, BJT, MOSFET, JFET and circuits like rectifier, oscillator , regulators and digital electronics circuits. It is one of the foundation course, which is required for students to understand working of complex electronic circuits and systems suitable in electrical engineering applications. It also gives information about rectifiers, filters, different oscillator circuits, voltage regulator and digital circuits with their applications for effective functioning in the field of electrical engineering.

Although best possible care has been taken to check for errors (if any) in this laboratory manual, perfection may elude us as this is the first edition of this manual. Any errors and suggestions for improvement are solicited and highly welcome.

Programme Outcomes (POs) to be achieved through Practical of this Course

Following programme outcomes are expected to be achieved through the practical of the course:

PO1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Electrical engineering problems.

PO2. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.

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

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

PO5. **The engineer and society:** Assess social, health, safety, legal and cultural issues and the consequent responsibilities relevant to practice in the field of Electrical engineering.

PO6. **Environment and sustainability:** Apply Electrical engineering solutions also for sustainable development practices in social and environmental contexts.

PO7. **Ethics:** Apply ethical principles for commitment to professional ethics, responsibilities and norms of the practice also in the field of Electrical engineering.

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

PO9. **Communication:** Communicate effectively in oral and written form.

PO10. **Life-long learning:** Engage in independent and life-long learning activities in the context of technological changes also in the Electrical engineering and allied industry.

Practical- Course Outcome matrix

	Course Outcomes (COs): a. Use relevant diode in different electronics circuits. b. Use diode in rectifiers and filters. c. Use BJT and FET in electronics circuits. d. Use DC regulated power supply. e. Use Transistor as an oscillator. f. Use of logic gates in electronics circuits.						
S. No.	**Practical Outcome**	**CO a.**	**CO b.**	**CO c.**	**CO d.**	**CO e.**	**CO f.**
1.	Test the performance of PN junction diode.	√	-	-	-	-	-
2.	Test the performance of Zener diode.	√	-	-	-	-	-
3.	Test the performance of photo diode by varying the light intensity as well as distance of the light source.	√	-	-	-	-	-
4.	Build/test half wave rectifier on breadboard.	-	√	-	-	-	-
5.	Build/test full wave rectifier on breadboard using two diodes.	-	√	-	-	-	-
6.	Build/test full wave rectifier on breadboard using four diodes.	-	√	-	-	-	-
7.	Use LC filter for getting minimum ripples using two diodes.	-	√	-	-	-	-
8.	Use π filter for getting minimum ripple using four diodes.	-	√	-	-	-	-
9.	Identify the terminals of the PNP and NPN transistor	-	-	√	-	-	-
10.	Build and test zener voltage regulator for the given voltage.	-	-	-	√	-	-
11.	Test the various blocks of regulated DC power supply.	-	-	-	√	-	-
12.	Find out faults at different stages of regulated DC power supply.	-	-	-	√	-	-
13.	Troubleshoot given DC regulated power supply.	-	-	-	√	-	-
14.	Test the performance of Regulator IC's: IC's 78XX, 79XX.	-	-	-	√	-	-
15.	Test the performance of IC 723 as Regulator.	-	-	-	√	-	-
16.	Test the performance of given logic gate ICs.	-	-	-	-	-	√
17.	Test the performance of given flip flop ICs.	-	-	-	-	-	√

List of Industry Relevant Skills

The following industry relevant skills of the competency "**Use electronic components and circuits in electrical equipment**" are expected to be developed in the student by undertaking the practical of this laboratory manual.

1. Identify the electronic component.
2. Test electronic component
3. Select the electronic component of proper value as per the requirement.
4. Mount the electronic component on breadboard as per circuit diagram.
5. Test the circuit for the given application.
6. Compare the observed output with the expected output.
7. Find faults and trouble shoot the given circuit.

Guidelines to Teachers

1. Teacher should provide the guideline with demonstration of practical to the students with all features.
2. Teacher shall explain prior concepts to the students before starting of each practical
3. Involve students in performance of each experiment.
4. Teacher should ensure that the respective skills and competencies are developed in the students after the completion of the practical exercise.
5. Teachers should give opportunity to students for hands on experience after the demonstration.
6. Teacher is expected to share the skills and competencies to be developed in the students.
7. Teacher may provide additional knowledge and skills to the students even though not covered in the manual but are expected the students by the industry.
8. Finally give practical assignment and assess the performance of students based on task assigned to check whether it is as per the instructions.
9. If practical is in two parts -Part I and Part II it should be conducted in two weeks.
10. Teacher is expected to refer complete curriculum document and follow guidelines for implementation

Instructions for Students

1. Listen carefully the lecture given by teacher about course, curriculum, learning structure, skills to be developed.
2. Organize the work in the group and make record of all observations.
3. Students shall develop maintenance skill as expected by industries.
4. Student shall attempt to develop related hand-on skills and gain confidence.
5. Student shall develop the habits of evolving more ideas, innovations, skills etc. those included in scope of manual
6. Student shall refer technical magazines, IS codes and data books.
7. Student should develop habit to submit the practical on date and time.
8. Student should well prepare while submitting write-up of exercise.

Content Page

List of Practicals and Progressive Assessment Sheet

S. No	Practical Outcome	Page No.	Date of performance	Date of submission	Assessment marks(25)	Dated sign. of teacher	Remarks (if any)
1.	Test the performance of PN junction diode.	1					
2.	Test the performance of Zener diode.	8					
3.	Test the performance of photo diode by varying the light intensity as well as distance of the light source.	16					
4.	Build/test half wave rectifier on breadboard.	24					
5.	Build/test full wave rectifier on breadboard using two diodes.	32					
6.	Build/test full wave rectifier on breadboard using four diodes.	39					
7.	Use LC filter for getting minimum ripples using two diodes.	46					
8.	Use π filter for getting minimum ripple using four diodes.	53					
9.	Identify the terminals of the PNP and NPN transistor	60					
10.	Build and test zener voltage regulator for the given voltage.	69					
11.	Test the various blocks of regulated DC power supply.	78					
12.	Find out faults at different stages of regulated DC power supply.	85					
13.	Troubleshoot given DC regulated power supply.	91					
14.	Test the performance of Regulator IC's: IC's 78XX, 79XX.	100					
15.	Test the performance of IC 723 as Regulator.	107					
16.	Test the performance of given logic gate ICs.	115					
17.	Test the performance of given flip flop ICs	122					
Total							

- To be transferred to Proforma of CIAAN-2017.

Practical No.1: Test the Performance of PN Junction Diode.

I Practical Significance:

PN Junction diode is used in industries as well as in domestic applications such asdetector circuits,wave shaping circuits and in rectifier of DC Power Supplies. For these applications diode selection plays vital role. In this practical students will draw V-I characteristics of the given diode to understand diode behavior with respect to change in voltage.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical technologies and tools with an understanding of the limitations.

III Competency and Practical Skills

This practical isexpected to develop the following skills for the industry-identified competency: '**Use electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use DC Power supply to give different voltages.
4. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

Use relevant diode in different electronics circuits.

V Practical Outcome

Test V-I characteristics of PN Junction diode to:

1. Measure static resistance of a given diode.
2. Measure dynamic resistance of a given diode.
3. Determine knee voltage of a given diode.

VI Relevant Affective domain unrelated Outcome(s)

Handle components and equipment carefully.

VII Minimum Theoretical Background

A PN Junction Diode is one of the simplest semiconductor devices, and it has the characteristic of passing current in one direction only. If a suitable positivevoltage (forward bias) is applied between the two ends of the PN junction, it can supply free electrons and holes with the extra energy they require to cross the junction as the width of the depletion layer around the PN junction is decreased.

Static resistance (R_{static}) of a PN junction diode is a ratio of forward voltage (V_F) to the forward current (I_F).

$$R_{static} = V_F/I_F$$

Dynamic resistance ($R_{dynamic}$) of a PN junction diode is a ratio of small change in forward voltage (ΔV_F) to small change the forward current (ΔI_F).

$$R_{dynamic} = \Delta V_F / \Delta I_F$$

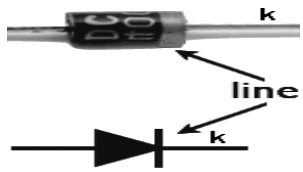


Figure 1: Diode and its symbol

Courtesy: (https://www.google.co.in/search?q=image+of++1n4007+diode&)

VIII Practical Circuit Diagram :

a) Sample

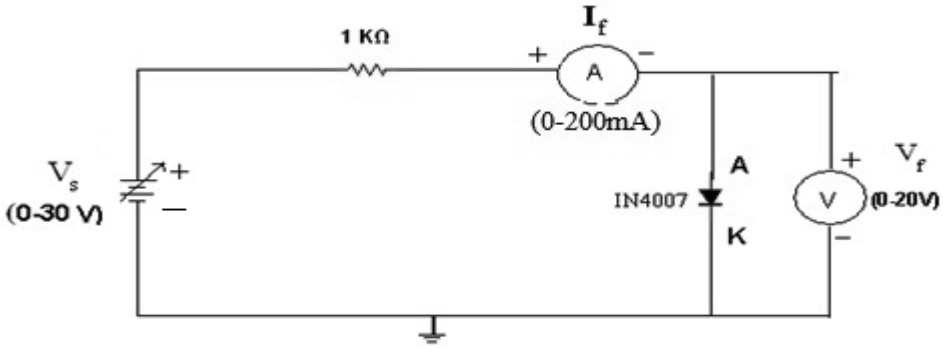


Figure 2: Circuit diagram of diode in forward bias

b) Actual Circuit used in laboratory

c) Actual Experimental set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2	1. Digital Multimeterwith diode testing facilities. 2. In place of Digital Multimeter, DCVoltmeter and DC ammeter can be used.
2.	DC Regulated power supply	Variable DC power supply 0-30V, 2A, SC protection, display for voltage and current.	1	
3.	Voltmeter	0-20 V	1	
4.	Ammeter	0 - 200 mA, 0 - 200 µA	1	
5.	Bread board	5.5 CM X 17CM	1	
6.	Diode	IN4001 (or any other equivalent diode)	1	
7.	Resistor	1KΩ(0.5watts/0.25watts)	1	
8.	Connecting wires	Single strand Teflon coating (0.6mm diameter)	As per requirement	

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 electrical circuit as in figure 2.
2. Switch ON the power supply.
3. Record the voltage V_F and current I_F in the observation table.
4. Increase the input voltage in step of 0.1 V
5. Record the voltage V_F and current I_F in the observation table.
6. Repeat steps 4 to 5 till 1 V is reached.
7. Plot the graph for the forward bias characteristics of diode bytaking V_F on X- axis and $I_F$on Y- axis.
8. Calculate the static resistance at a particular point.
9. Considering two points on the plotted graph, calculate dynamic resistance.

XII Resources used (with major specifications)

S. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			
4.			
5.			

XIII Actual procedure followed

……
……
……

XIV Precautions followed

……
……
……

XV Observations and Calculations:

Table 1: Measurement of V_F and I_F

Sr. No.	$V_{F(volts)}$	$I_{F(mA)}$
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Calculations:

Calculate static resistance at particular point

$$R_{static} = V_F \ / \ I_F$$

Calculate dynamic resistance:

$$R_{dynamic} = \Delta V_F \ / \ \Delta I_F$$

XVI Results

1. Static resistance of given diode = …….……
2. Dynamic Resistance of given diode = …….
3. Knee Voltage of given diode= ……..

XVII Interpretation of results

……..……..
…….....

XVIII Conclusions & Recommendation

……..……
…….……..……
…….

XIX Practical related Questions

Repeat the above experiment for germanium diode and find its knee voltage.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=_vKeaPHXF9U
2. https://www.youtube.com/watch?v=7U8NzRAvy-I
3. https://www.youtube.com/watch?v=UqJ258EPTkI
4. https://www.youtube.com/watch?v=Coy-WRCfems
5. http://www.mouser.com/ds/2/149/1N4007-888322.pdf

XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……
2. ……
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No. 2: Test the Performance of Zener Diode.

I Practical Significance:

In industries Zener diodes are widely used as voltage references and shunt regulators to regulate the voltage across circuits. Zener diodes are also used in over voltage protection circuits and switching applications. Zener are suitable for surge suppression circuits, for device protection, for clipping, clamping circuits and especially as peak clippers.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use DC Power supply to give different voltages.
4. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

Use relevant diode in different electronic circuits.

V Practical Outcome

1. Component identification skills
2. Component mounting skills
3. Use DC Power supply to give different voltages.
4. Use Digital multimeter to measure the voltage and current.

VI Relevant Affective domain related Outcome(s)

Handle components and equipment carefully.

VII Minimum Theoretical Background

Zener diode is formed by combining highly doped P and N semiconductor materials. It works on the principle of Zener breakdown and is normally operated in reverse breakdown region. In reverse breakdown region, high current flow through the diode leading to high power dissipation.

The Zener breakdown occurs when the electric field across the junction produced due to the reverse voltage is sufficiently high, this breaks covalent bonds. Thus a large numbers of carriers are generated which causes a more current to flow. This mechanism is called as Zener breakdown. After Zener breakdown the reverse current increases sharply.

Zener resistance of a Zener diode is a ratio of reverse Zener voltage to the reverse Zener current.

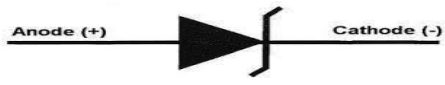

Figure 1: Symbol of Zener diode

VIII Practical Circuit Diagram :

a) Sample

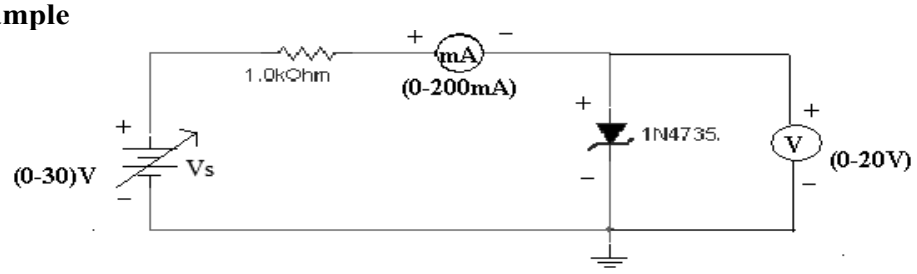

Figure 2: Zener diode in forward bias

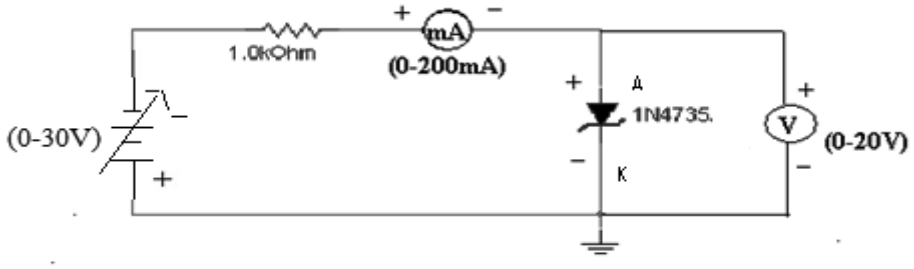

Figure 3: Zener diode in reverse bias

b) Actual Circuit used in laboratory

c) Actual Experimental set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Digital Multimeter	Digital Multimeter : 3 1/2 digit display.	2	1. Digital Multimeter with diode testing facilities will be preferred. 2. In place of Digital Multimeter, DC Voltmeter and DC ammeter can be used.
2.	DC Regulated power supply	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1.	
3.	Voltmeter	0-20 V	1	
4.	Ammeter	(0 - 200 mA, 0 - 200 μA)	1	
5.	Bread board	5.5 CM X 17CM	1	
6.	Zener Diode	IN4735 (or any other equivalent diode)	1	
7.	Resistor	1KΩ(0.5watts/0.25watts)	1	
8.	Connecting wires	Single strand Teflon coating (0.6mm diameter)	As per requirement	

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 Zener 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 circuit as shown in figure 2.
2. Switch ON the power supply.
3. Increase the input voltage in step of 0.1 V
4. Record the voltage V_F and current I_F in the observation table no1.
5. Repeat steps 3 to 4 till 1 V is reached.
6. Plot the graph for the forward bias characteristics of Zener diode by taking V_F on X-axis and I_F on Y-axis.
7. Connect the circuit as shown in figure 3.
8. Vary input voltage gradually in steps of 1V up to 12V.
9. Record the corresponding readings of V_R and I_R in the observation table no 2.
10. Plot the graph for the reverse bias characteristics of Zener diode by taking V_F on X-axis and I_F on Y-axis.

XII Resources used (with major specifications)

S. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			
4.			
5.			

XIII Actual procedure followed

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……
……..……..

XIV Precautions followed

……
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……..……..

XV Observations and Calculations:

Table 1: Measurement of V_F and I_F

S.No.	$V_{F(V)}$	$I_{F(mA)}$
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Table 2: Measurement of V_R and I_R

S.No.	$V_{R(V)}$	$I_{R(mA)}$
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Calculations:

$$R_Z = V_F / I_F$$

$$R_Z = V_R / I_R$$

XVI Results

1. Zener breakdown voltage = ……..
2. Forward resistance of zener diode = …….

XVII Interpretation of result

……
……

XVIII Conclusions

……
……

XVIII Practical related Questions

1. What is the value of zener voltage for given zener diode?
2. What is the maximum value of reverse current forgiven zenerdiode.
3. What is the effect on voltage across zener diode and current flowing through it, when reverse voltage across it is more than breakdown voltage?.
4. Which portion of zener diode characteristics is most useful for voltage regulator applications?

[Space for Answers]

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XIX References / Suggestions for further Reading

https://www.youtube.com/watch?v=itzPT3UbClI

XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Interpretation of result	15 %
6	Conclusions	05 %
7	Practical related questions	15 %
8	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No. 3: Test the Performance of Photo Diode by Varying the Light Intensity As Well As Distance of the Light Source.

I Practical Significance:

In industry and domestic applications, photodiodes are used in applications of photo detectors like charge-coupled devices, photoconductors, and photomultiplier tubes. These diodes are used in consumer electronics applications like smoke detectors, compact disc players, and televisions remote controls. Photodiodes are frequently used for exact measurement of the intensity of light in scientific and industry applications. Generally, they have an enhanced, more linear response than photoconductors. These diodes are much faster and more complex than normal PN junction diodes and hence are frequently used for lighting regulation and in optical communications.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use DC Power supply to give different voltages.
4. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

Use relevant diode in different electronics circuits.

V Practical Outcome

Test the performance of Photodiode by varying the light intensity and distance of the light source.

VI Relevant Affective domain related Outcome(s)

1. Handle components and equipment carefully.
2. Select instruments of required range.

VII Minimum Theoretical Background

A photodiode is a two terminal PN-junction diode that is operated by first reverse biasing the junction and then illuminating it by light energy to produce electric current. It is also called as photo-detector/light detector/photo-sensor. These diodes are designed to work in **reverse bias** condition, it means that the P-side of the photodiode is associated with the negative terminal of the battery and N-side is connected to the positive terminal of the battery. This diode is very sensitive to light so when light falls on the diode it changes light into electric current.

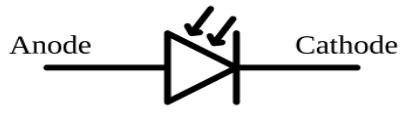

Figure 1: Symbol of Photo Diode

Figure 2: Photo Diode

Photo Current (I_λ): It is the reverse current produced due to thermally generated electron-hole pairs in depletion region due to incident light. Photo current is proportional to light intensity as light intensity increases photocurrent increases.

Dark Current: A reverse current flows when no light is incident on the device.

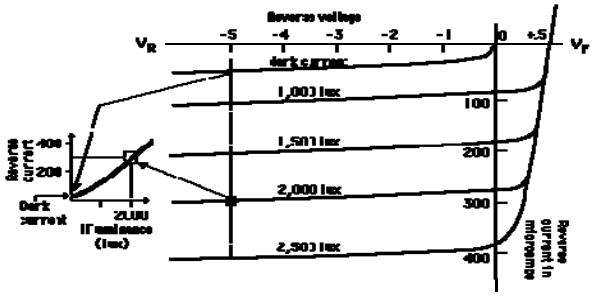

Figure 3: Plot of V_R versus V_F

VIII Practical Circuit Diagram :

a. Sample

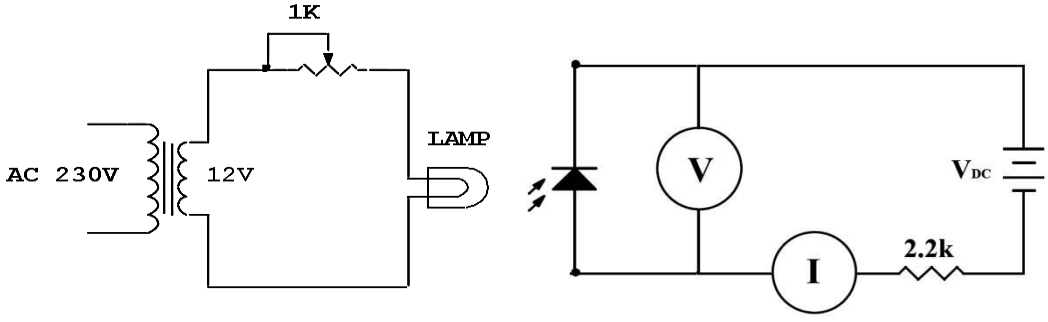

Figure 4: Experimental setup

b. Actual Circuit used in laboratory

c. Actual Experimental Set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Experimental kit/ breadboard	840 -1000 contact points: Positive and Negative power rails on opposite side of the board 5.5 CM X 17CM	1	
2.	Photo diode	BPW 34 or equivalent any other photodiode	1	
3.	Connecting wires	Single strand Teflon coating(0.6mm diameter)		
4.	Resistor	2.2KΩ 0.5Watt	1	
5.	Digital Multimeter	3 1/2 digit display	1	
6.	DC Power supply	0-30V,2A,SC protection, display for voltage and current	1	
7.	Lux meter/Optical power meter,	3000 Lumen, Battery operated hand held type	1	
8.	Light source.	Portable Lamp mounted on stand	1	

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

Test performance of photo diode by varying the light intensity.

1. Select the component as per circuit diagram.
2. Make the connections as per circuit diagram.
3. Apply the reverse voltage, and measure the current when light is not incident.
4. Increase the reverse voltage and light intensity in step and note down the photocurrent.
5. Change the light intensity and repeat the steps.
6. Plot the graph of reverse voltage (negative X-Axis) V_S reverse photo current (negative Y-Axis) for various light intensity.

Test performance of photo diode by varying distance of the light source.

1. Select the component as per circuit diagram.
2. Make the connections as per circuit diagram.
3. Apply the reverse voltage, and measure the current when light is not incident.
4. Keep the input voltage constant at which we get sufficient light intensity and vary the distance of light source from photo diode in step and note down the photocurrent.
5. Plot the graph of reverse voltage (negative X-Axis) V_S reverse photo current (negative Y-Axis) for various light intensity.

XII Resources used (with major specifications)

S. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			
4.			
5.			

XIII Actual procedure followed

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XIV Precautions followed

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XV Observations and Calculations:

Table 1: Measurement of Photodiode current when light intensity is varied

Light Intensity	No light Condition (Lux meter reading ----)		Low Light Condition (Lux meter reading ----)		High Light condition (Lux meter reading ----)	
Sr. No.	V_R Volts	Ip (µA)	V_R Volts	Ip (µA)	V_R Volts	Ip (µA)
1	2					
2	4					
3	6					
4	8					
5	10					
6	12					
7	14					
8	16					

Table 2Measurement of Photodiode current when distance is varied

Light Intensity	Position I No light condition (Distance of light source in cm ----)		Position II (Distance of light source in cm ----)		Position III (Distance of light source in cm ----)	
Sr. No.	V_R Volts	Ip (µA)	V_R Volts	Ip (µA)	V_R Volts	Ip (µA)
1	2					
2	4					
3	6					
4	8					
5	10					
6	12					
7	14					
8	16					

Calculations:

XVI Results

Dark Current: _____

XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Write specification of photodiode used in above performance.

[Space for Answers]

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XX References / Suggestions for further Reading

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
6. http://www.osioptoelectronics.com/application-notes/an-photodiode-parameters-characteristics.pdf

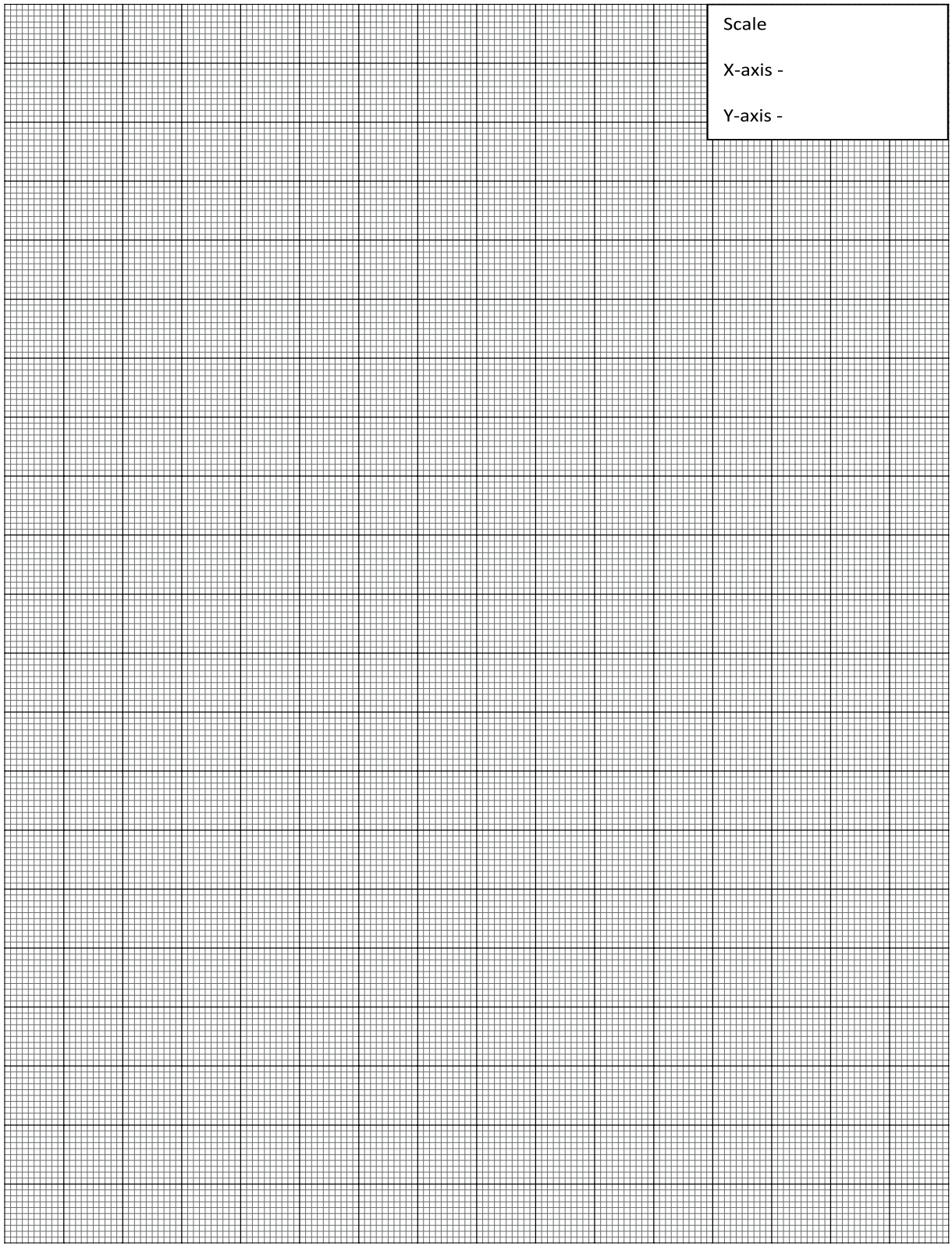
XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Interpretation of result	15 %
6	Conclusions	05 %
7	Practical related questions	15 %
8	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……..……..
2. ……..……...
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No.4: Build and Test Half Wave Rectifier on Breadboard.

I Practical Significance:

AC power is more efficiently and economically transmitted. The majority of electronic equipment, devices work on DC power. It becomes necessary to convert AC power into DC power. In half wave rectifier single diode is used. The current flows in only one direction through diode. So it is unidirectional device.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical technologies and tools with an understanding of the limitations.

III Competency and Skills

This practical is expected to develop the following skills for the industry-identified competency: **'Use electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use CRO to observe input output waveforms.
4. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

Use diode in rectifiers and filters.

V Practical Outcome

Test half wave rectifier on Breadboard:

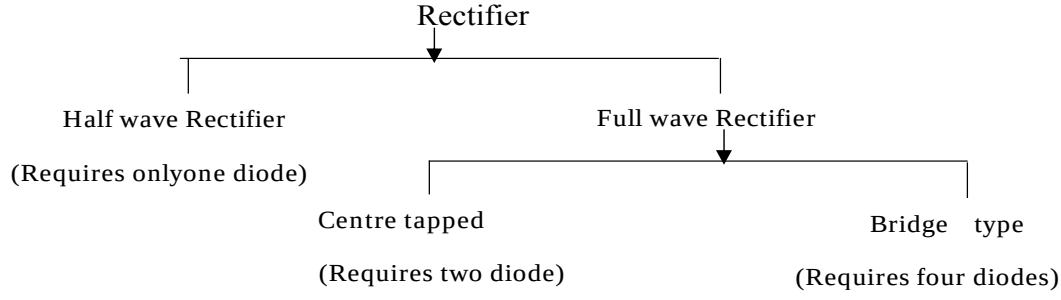
1. Observe output Waveform on CRO.
2. Use of DMM to measure the output voltage.

VI Relevant Affective domain related Outcome(s)

Handle components and equipment carefully.

VII Minimum Theoretical Background

Rectifier: - It is a circuit, which converts AC signal into the Pulsating DC signal.



Half wave Rectifier: DC or average output voltage of half wave rectifier is V_m/π as the output current flows only for half the cycle of input signal.

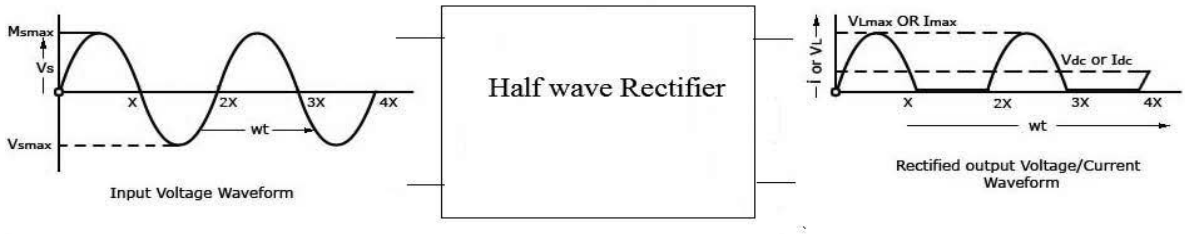


Figure 1: Half Wave rectifier.

Courtesy: (*www.Circuit.Today.com)*

VIII Practical Circuit Diagram :

a. Sample

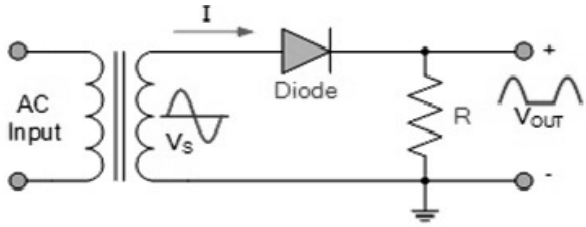


Figure 2: Circuit diagram of Half Wave rectifier.

b. Actual Circuit used in laboratory

c. Actual Experimental Set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Transformer	Step down 9-0-9 V 500mA	1	
2.	Digital Multimeter	Digital Multimeter: 3 1/2-digit display.	2	1. Digital Multimeter with diode testing facilities will be preferred.
3.	CRO	25 MHz ,dual scope	1	
4.	Bread board	5.5 CM X 17CM	1	
5.	Diode	IN4007 (or any other equivalent diode)	1	
6.	Resistor	1KΩ/10KΩ(0.5watts/0.25watts)	1	
7.	Connecting wires	Single strand Teflon coating(0.6mm diameter)	As per requirement	

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.

XI Procedure

1. Make the connection as per the circuit diagram shown in figure 2.
2. Connect the CRO probe across the Secondary and measure the Vp-p appearing across the diodes.
3. Now connect the CRO probes across the resistance R_L and Measure the peak value of output voltage (V_m).
4. Observe the waveform on CRO and draw it on graph paper.
5. From the measure the peak value of output voltage (V_m), calculate the average or dc value of output voltage(V_{dc}).
6. Connect the DMM across the R_L and measure the dc voltage.
7. Compare the value calculated in step 5 with the value measured in step 6.
8. Tabulate the readings in Table1.

XII Resources used (with major specifications)

S. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			
4.			
5.			

XIII Actual procedure followed

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XIV Precautions followed

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XV Observations and Calculations:

Table 1

Type of rectifier	Rectifier Output on CRO (V_m)	V_{dc} Calculated (using Formula $V_{dc} = (V_m/\pi)$	V_{dc} Measured (using DMM)	Comment

Calculations: Calculate V_{dc}using Formula:

$$V_{dc} = (V_m/\pi)$$

XVI Results

DC output voltage of Half wave rectifier

1. Calculated V_{dc}(CRO)= …… V
2. Measured V_{dc}(DMM)= …….. .V

XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Repeat the above experiment for silicon diode of different specification.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=_vKeaPHXF9U
2. https://www.youtube.com/watch?v=7U8NzRAvy
3. https://www.youtube.com/watch?v=UqJ258EPTkI
4. https://www.youtube.com/watch?v=Coy-WRCfems
5. http://www.mouser.com/ds/2/149/1N4007-888322.pdf

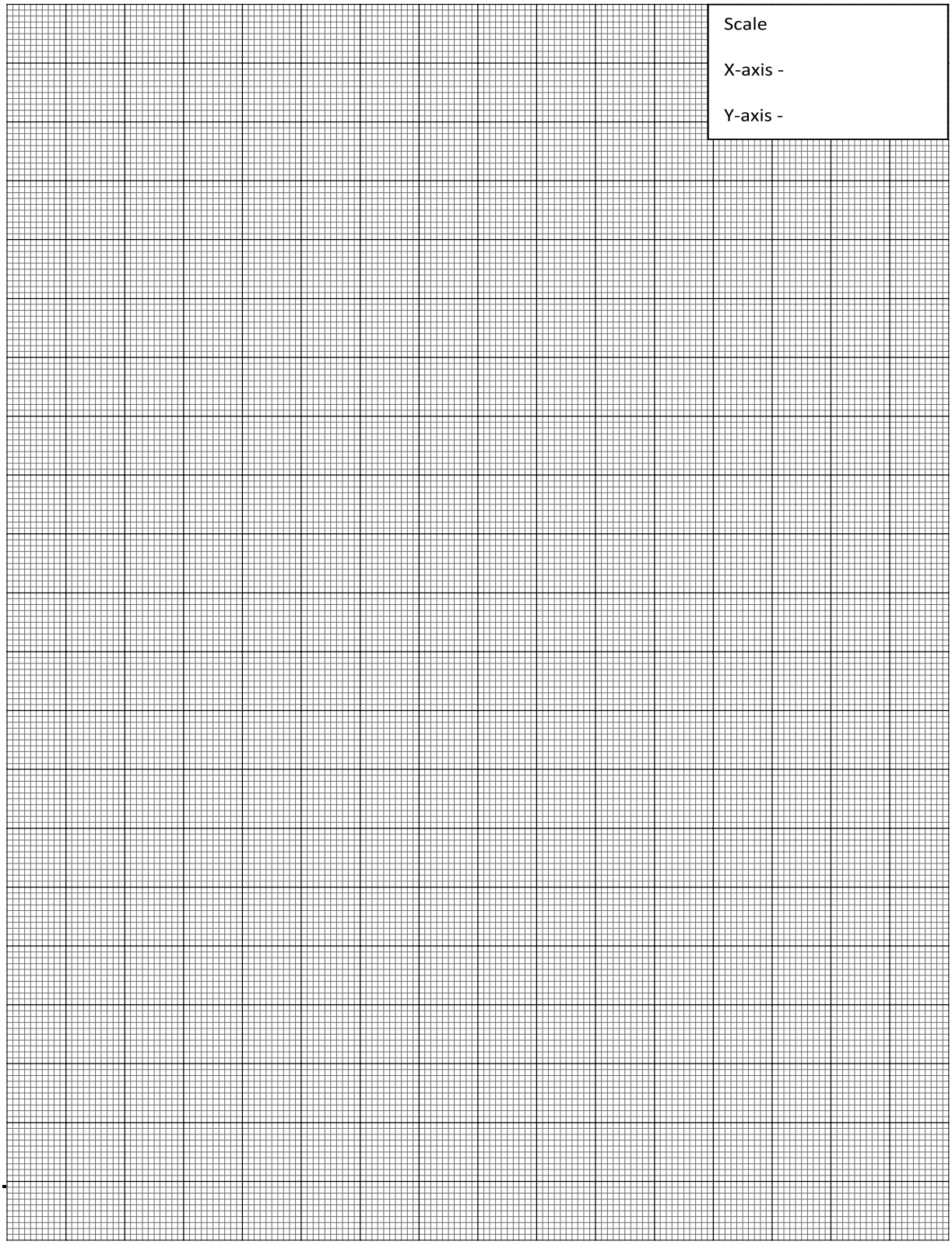
XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculation of theoretical values	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……
2. ……
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	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X-axis -
Y-axis -

Practical No. 5: Build/ Test Full Wave Rectifier on Breadboard Using Two Diodes.

I Practical Significance

Electric power is usually transmitted in AC form. However certain applications needs DC power supply such as electronic appliances. Hence, AC mains need to be rectified using rectifier when DC power is required.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

Use diode in rectifiers and filters.

V Practical Outcome

Convert AC signal into DC signal using Half wave rectifier:

1. Sketch circuit diagram of Half Wave Rectifier and label components.
2. Observe the waveform of Half Wave Rectifier on CRO at various test points.

VI Relevant Affective domain related Outcome(s)

Handle components and equipment carefully

VII Minimum Theoretical Background

Rectifier is an electronic device used for converting AC into pulsating 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 Full wave rectifier utilizes both the cycle of input AC voltage. Two diodes are used in full wave center tapped rectifier. Center Tapped Full wave rectifier using two diodes is shown in the figure 1. Center tapped transformer is used in this full wave rectifier. During the positive cycle diode D1 conducts and D2 remains OFF. During negative cycle diode D1 remains OFF but diode D2 is ON. Note that direction of current in the load resistance is same during both the cycles hence output consists of only positive cycles.

VIII Circuit diagram:

(a) Sample

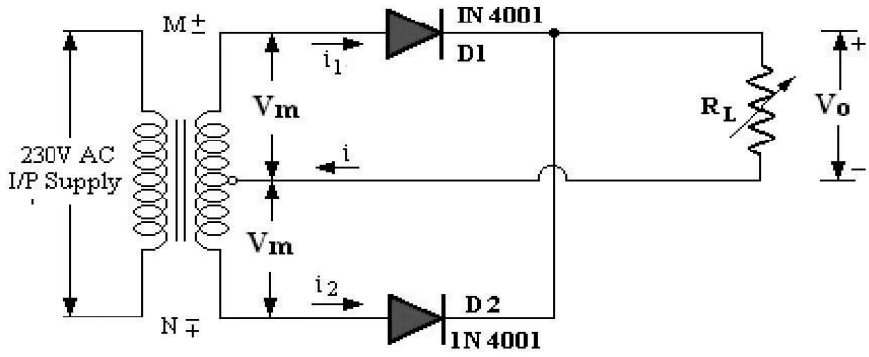

Figure 1:Full wave rectifier without filter.

(b) Actual Circuit used in laboratory

(c) Actual Experimental set up used in laboratory

IX Resources required

S. No.	Instrument /Object	Specification	Quantity
1.	Transformer (center tapped)	12-0-12 V AC, 500 mA	1
2.	Resistor	10K Ω,0.5 Watt	1
3.	Diode	Silicon 1N4007	2
4.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	1
5.	Bread board	5.5 CM X 17CM	1
6.	CRO	25 MHz Dual trace	1
7.	Connecting wires	Single strand Teflon coating (0.6mm diameter)	1

X Precautions to be Followed

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. While doing the practical do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode.

XI Procedure

1. Connect the circuit for Center Tapped Full wave rectifier on breadboard 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 Vs_{p-p} appearing across diode.
3. Measure the peak value of output voltage (V_m) across the resistance R_L.
4. Draw input and output waveforms of full wave rectifier.
5. Calculate the average or dc value of output voltage.
6. Using DMM measure the DC voltage at the load resistance R_L.
7. Compare the value calculated in step 5 with the value measured in step 6.
8. Tabulate the readings in Table1.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

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XIV Precautions Followed

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XV Observations and Calculations

Table 1.

Type of rectifier	Rectifier Output on CRO (V_m)	V_{dc} Calculated (using Formula $V_{dc} = (2V_m/\pi)$	V_{dc} Measured (using DMM)	Comment

Calculations:

$$V_{dc}=2V_m/\pi$$

XVI Results

V_{dc} calculated = ……..……. V

XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

1. Calculate frequency of waveform obtained at the output of full wave rectifier
2. Compare half wave and Full wave rectifier based on output waveforms obtained in Laboratory.

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XX References / Suggestions for further Reading

1. http://nptel.ac.in/courses/
2. www.electronics-tutorials.ws › Diodes

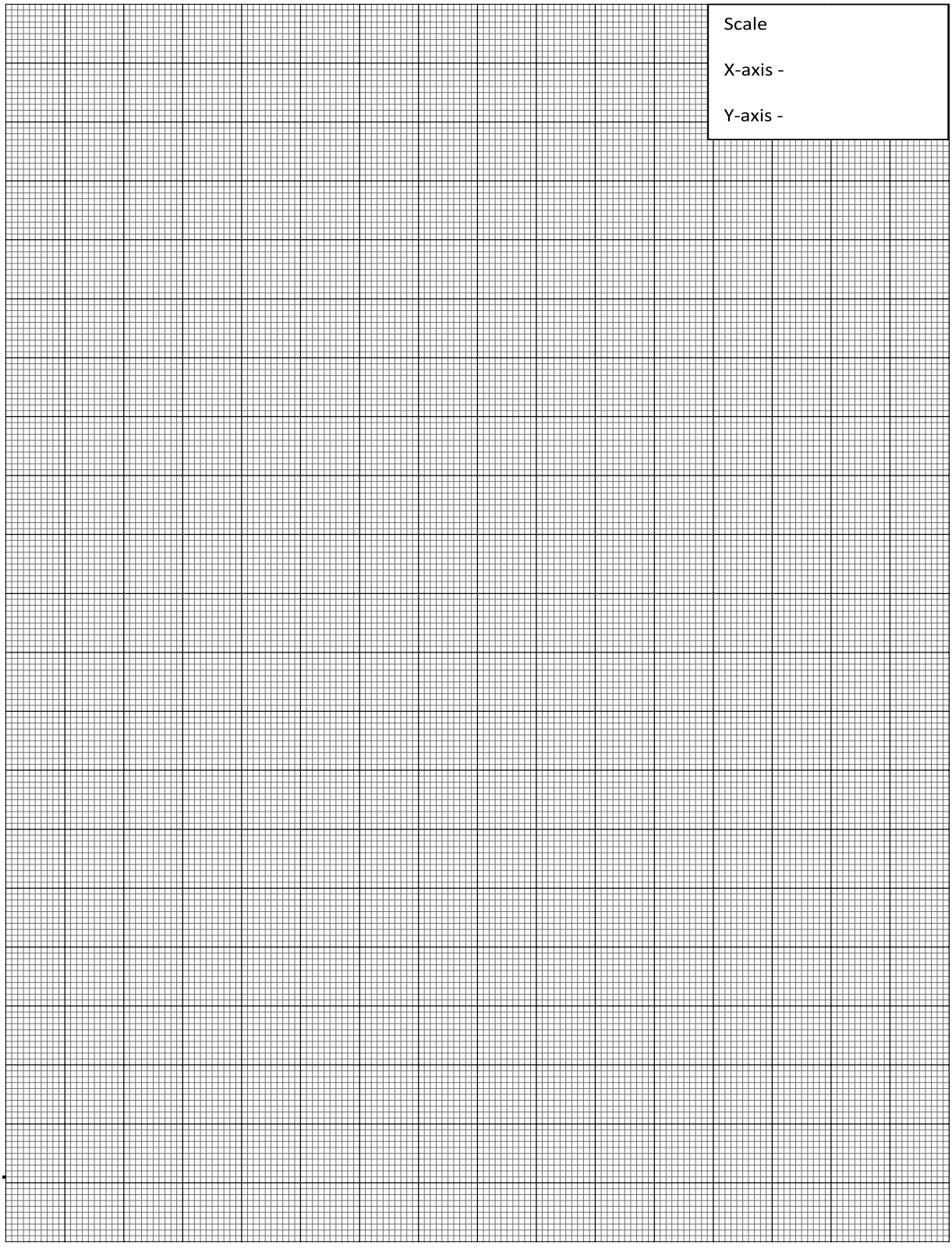
XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……
2. ……
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	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Y-axis -

1N4001 - 1N4007
General-Purpose Rectifiers

Features

- Low Forward Voltage Drop
- High Surge Current Capability

DO-41
COLOR BAND DENOTES CATHODE

Ordering Information

Part Number	Top Mark	Package	Packing Method
1N4001	1N4001	DO-204AL (DO-41)	Tape and Reel
1N4002	1N4002	DO-204AL (DO-41)	Tape and Reel
1N4003	1N4003	DO-204AL (DO-41)	Tape and Reel
1N4004	1N4004	DO-204AL (DO-41)	Tape and Reel
1N4005	1N4005	DO-204AL (DO-41)	Tape and Reel
1N4006	1N4006	DO-204AL (DO-41)	Tape and Reel
1N4007	1N4007	DO-204AL (DO-41)	Tape and Reel

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only. Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value							Unit
		1N 4001	1N 4002	1N 4003	1N 4004	1N 4005	1N 4006	1N 4007	
V_{RRM}	Peak Repetitive Reverse Voltage	50	100	200	400	600	800	1000	V
$I_{F(AV)}$	Average Rectified Forward Current .375 " Lead Length at T_A = 75°C	1.0							A
I_{FSM}	Non-Repetitive Peak Forward Surge Current 8.3 ms Single Half-Sine-Wave	30							A
I^2t	Rating for Fusing (t < 8.3 ms)	3.7							A^2sec
T_{STG}	Storage Temperature Range	-55 to +175							°C
T_J	Operating Junction Temperature	-55 to +175							°C

Thermal Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Value	Unit
P_D	Power Dissipation	3.0	W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	50	°C/W

Electrical Characteristics

Values are at T_A = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Value	Unit
V_F	Forward Voltage	I_F = 1.0 A	1.1	V
I_{rr}	Maximum Full Load Reverse Current, Full Cycle	T_A = 75°C	30	µA
I_R	Reverse Current at Rated V_R	T_A = 25°C	5.0	µA
		T_A = 100°C	50	
C_T	Total Capacitance	V_R = 4.0 V, f = 1.0 MHz	15	pF

Practical No.6: Build and Test Full Wave Rectifier On Breadboard Using Four Diodes.

I Practical Significance

A bridge rectifier is an arrangement of four diodes in a bridge configuration, which provides the same output polarity for either input polarity. It is used for converting an alternating current (AC) input into a direct current (DC) output. Bridge rectifier are widely used in power supply circuit.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use Digital multimeter to measure the voltages.

IV Relevant Course Outcomes

Use diode in rectifiers and filters.

V Practical Outcome

Convert AC signal into DC signal using Full wave rectifier:

1. Build circuit of Full Wave bridge Rectifier on breadboard.
2. Observe the waveform of Full Wave Rectifier on CRO at various test points.

VI Relevant Affective domain related Outcome(s)

Handle components and equipment carefully.

VII Minimum Theoretical Background

The circuit diagram of the full wave bridge rectifier is shown in figure1. During positive half cycle diode D1 and D4 becomes forward bias and diode D2 and D3 becomes Reverse bias. Currents starts flowing through D1 and D4 which produces output voltage across Load Resistor R.

During negative half cycle diode D2 and D3 becomes forward bias and diode D1 and D4 becomes Reverse bias. Currents starts flowing through D2 and D3 which produces output voltage across Load Resistor R.

VIII Circuit diagram:

(a) Sample

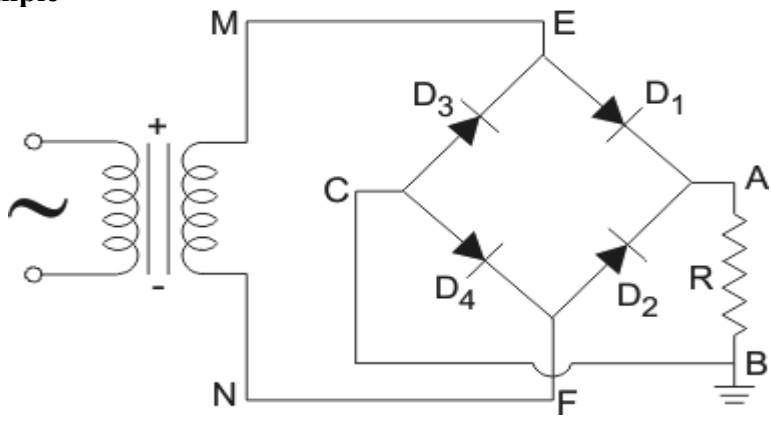

Figure 1.Full wave bridge rectifier

(b) Actual Circuit used in laboratory

(c) Actual Experimental set up used in laboratory

IX Resources required

S. No.	Instrument /Object	Specification	Quantity
1.	Transformer	9-0-9VAC, 500 mA	1
2.	Resistor	10KΩ 0.5 Watt	1
3.	Diode	Silicon 1N4007	4
4.	CRO	25MHz	1
5.	Bread board	5.5 CM X 17CM	
6.	Connecting wires	Single strand Teflon coating (0.6mm diameter)	As per requirement

X Precautions to be Followed

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. While doing the practical do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode.

XI Procedure

1. Connect the circuit for full wave bridge rectifier on bread board 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 connect the CRO to the load resistor.
5. Measure the peak voltage V_m(peak voltage) across load resistor.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

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……

XIV Precautions Followed

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XV Observations and Calculations

Table 1

Sr. No.	Rectified output across R (V_m)
1	
2	

Calculations: NA

XVI Results

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XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Sketch DC output voltage of Half wave, Centre tapped Full waveRectifier and Full wave Bridge rectifier for the same AC input and comment on it .

[Space for Answers]

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XX References / Suggestions for further Reading

1. http://nptel.ac.in/courses/
2. http://www.circuitstoday.com/full-wave-bridge-rectifier.
3. https://www.electrical4u.com/bridge-rectifiers/

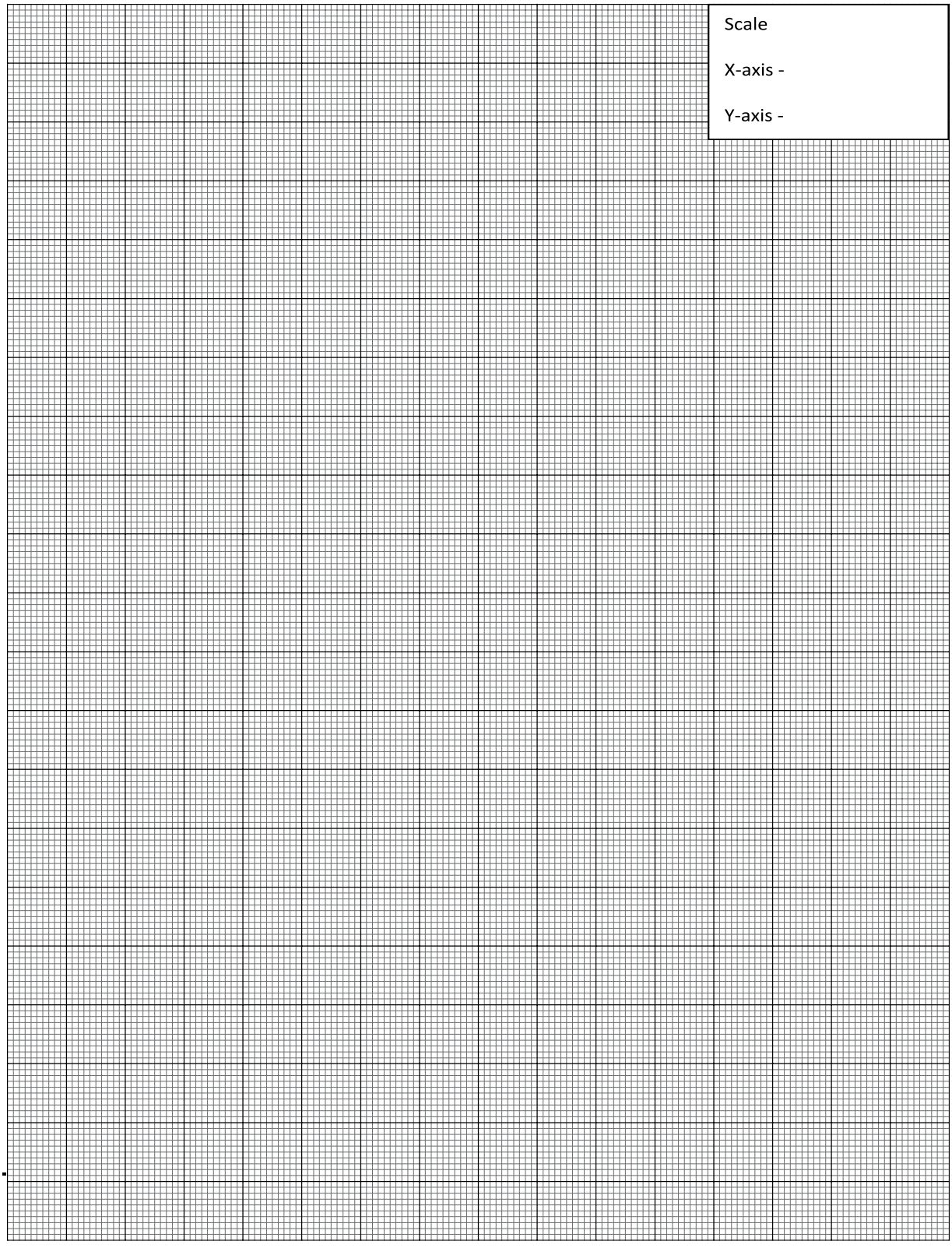
XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Interpretation of result	15 %
6	Conclusions	05 %
7	Practical related questions	15 %
8	Submitting the journal in time	05%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. ……...
2. ……...
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No.7: Use LC Filter for Getting Minimum Ripples Using Two Diodes

I Practical Significance

The filter converts the pulsating DC into pure DC. The electronic reactive elements like capacitor and inductors are used for filtering.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

- Use diode in rectifiers and filters.

V Practical Outcome

Use LC filter to remove the ripples at the output of full wave rectifier:

1. Build circuit of Full Wave Rectifier with LC filter on bread board.
2. Observe the waveform at output of Full Wave Rectifier and LC filter.

VI Relevant Affective domain related Outcome(s)

Handle components and equipment carefully

VII Minimum Theoretical Background

The capacitor used in "C" filter reduces the ripple voltage, but causes the diode current to increase. This large current may damage the diode and will further cause heating problem and decrease the efficiency of the filter. On the other hand, a simple series inductor reduces both the peak and effective values of the output current and output voltage. So the combination of both the filter (L and C), forms a new filter called the L-C filter which will have a good efficiency, with controlled diode current and enough ripple removal factor. The voltage stabilizing action of shunt capacitor and the current smoothing action of series inductor filter can be combined to form a perfect practical filter circuit.

VIII Circuit diagram:

a. Sample

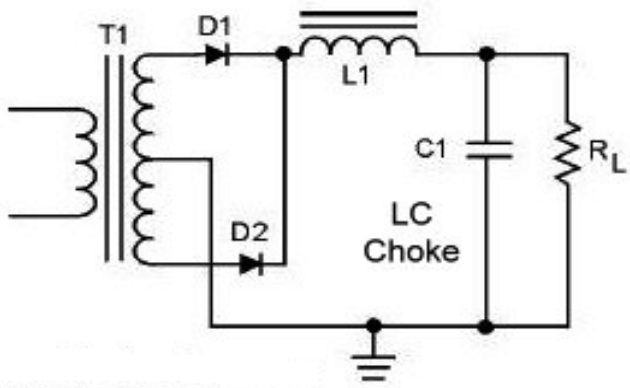


Figure 1:Full wave rectifier with LC filter.

b. Actual Circuit used in laboratory

c. Actual Experimental Set up used in laboratory

IX Resources required

S. No.	Instrument /Object	Specification	Quantity
1.	Transformer (center tapped)	12-0-12 V AC, 500 mA	1
2.	Resistor	10K Ω 0.5 Watt.	1
3.	Diode	Silicon 1N4007	2
4.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	1
5.	Capacitor, Inductor	Suitable rating	1
6.	C.R.O.	25MHz	1
7.	Bread board	5.5 CM X 17CM	
8.	Connecting wires	Single strand Teflon coating (0.6mm diameter)	As per requirement

X Precautions to be Followed

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. While doing the practical do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode

XI Procedure

1. Connect the circuit of rectifier with LC Filter 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. Record peak voltage across load resistor using CRO.
5. Calculate the DC output voltage and peak to peak ripple voltage.
6. Calculate the ripple factor.
7. Observe and draw the waveforms across LC filter on graph paper.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

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XIV Precautions Followed

……

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XV Observations and Calculations

Table 1

Type of Rectifier	Peak Voltage Vm (volts)	Vdc= 2Vm/π (volts)	Peak to peak ripple voltage Vr(volts)	Ripple factor= Vr/Vdc
Full wave rectifier				

XVI Results

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XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Repeat the above experiment using C filter and comment on ripple factor.

[Space for Answers]

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XX References / Suggestions for further Reading

1. http://www.physics-and-radio-electronics.com/electronic-devices-and-circuits/rectifier/halfwaverectifierwithfilter.htmlhttp://nptel.ac.in/courses /117103063/4
2. https://www.elprocus.com/half-wave-rectifier-circuit-working-principle-and-characteristics-2/
3. http://www.physics-and-radio-electronics.com/electronic-devices-and-circuits/rectifier/halfwaverectifierwithfilter.html

XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Interpretation of result	15 %
6	Conclusions	05 %
7	Practical related questions	15 %
8	Submitting the journal in time	05%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. ……
2. ……
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No. 8: Use Π Filter For Getting Minimum Ripple Using Four Diodes.

I Practical Significance

The filter converts the pulsating DC into pure DC. The electronic reactive elements like capacitor and inductors are used for filtering.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

Use diode in rectifiers and filters.

V Practical Outcome

Use **π** filter to remove the ripples at the output of bridge rectifier:

1. Build the circuit of bridge rectifier with π filter.
2. Observe the waveform at output of bridge rectifier with π filter.

VI Relevant Affective domain related Outcome(s)

Handle components and equipment carefully

VII Minimum Theoretical Background

This filter is basically a capacitor filter followed by an LC filter. Since its shape (C-L- C) is like the letter π it is called π – filter. It is also called capacitor input filter because the rectifier feeds directly into the capacitor C. Here the first capacitor C offers a low reactance to AC. component of rectifier output but provide more reactance to DC components. Therefore most of the AC components will bypass through C and the DC component flows through chock L. The choke offers very high reactance to the AC component. Thus it blocks AC components while pass the DC. The capacitor C_f bypasses any other AC component appears across the load.

VIII Circuit diagram:

a. Sample

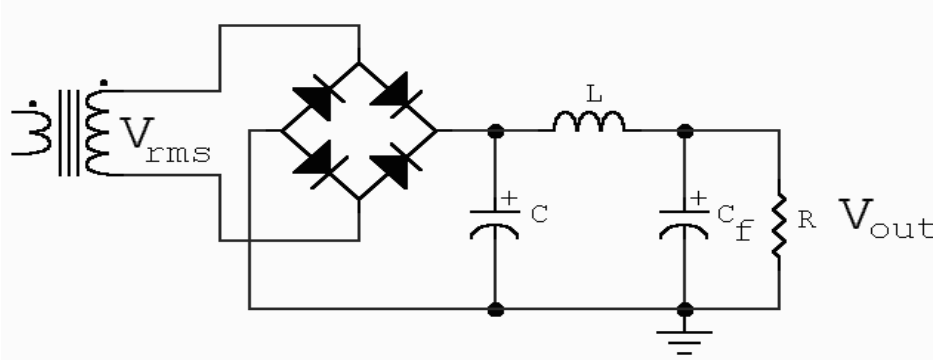

Figure1: Full wave bridge rectifier with π filter

b. Actual Circuit used in laboratory

c. Actual Experimental Set up used in laboratory

IX Resources required

S. No.	Instrument /Object	Specification	Quantity
1.	Transformer	0-12 V AC, 500 mA	1
2.	Resistor	10K Ω 0.5 Watt	1
3.	Diode	Silicon Diode 1N4007	4
4.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	1
5.	Capacitor, inductor	Suitable rating	2 Capacitor 1 Inductor
6.	C.R.O.	20MHz	1
7.	Bread board	5.5 CM X 17CM	
8.	Connecting wires	Single strand Teflon coating (0.6mm diameter)	As per requirement

X Precautions to be Followed

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. While doing the practical do not exceed the input voltage of the diode beyond the rated voltage of diode. This may lead to damaging of the diode.

XI Procedure

1. Connect the circuit of rectifier with π Filter 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. Record peak voltage across load resistor using CRO.
5. Calculate the DC output voltage and peak to peak ripple voltage.
6. Calculate the ripple factor.
7. Observe and draw the waveforms across π filter on graph paper.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

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XIV Precautions Followed

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XV Observations and Calculations

Table 1

Type of Rectifier	Peak Voltage Vm (volts)	Vdc= 2Vm/π (volts)	Peak to peak ripple voltage Vr(volts)	Ripple factor= Vr/Vdc
Full wave rectifier				

Calculations

XVI Results

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XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Repeat the above experiment using different value of C_f.

[Space for Answers]

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XX References / Suggestions for further Reading

1. http://www.physics-and-radio-electronics.com/electronic-devices-and-circuits/rectifier/halfwaverectifierwithfilter.htmlhttp://nptel.ac.in/courses /117103063/4
2. https://www.elprocus.com/full-wave-rectifier-circuit-working-principle-and-characteristics-2/
3. http://www.physics-and-radio-electronics.com/electronic-devices-and-circuits/rectifier/full waverectifierwithfilter.html

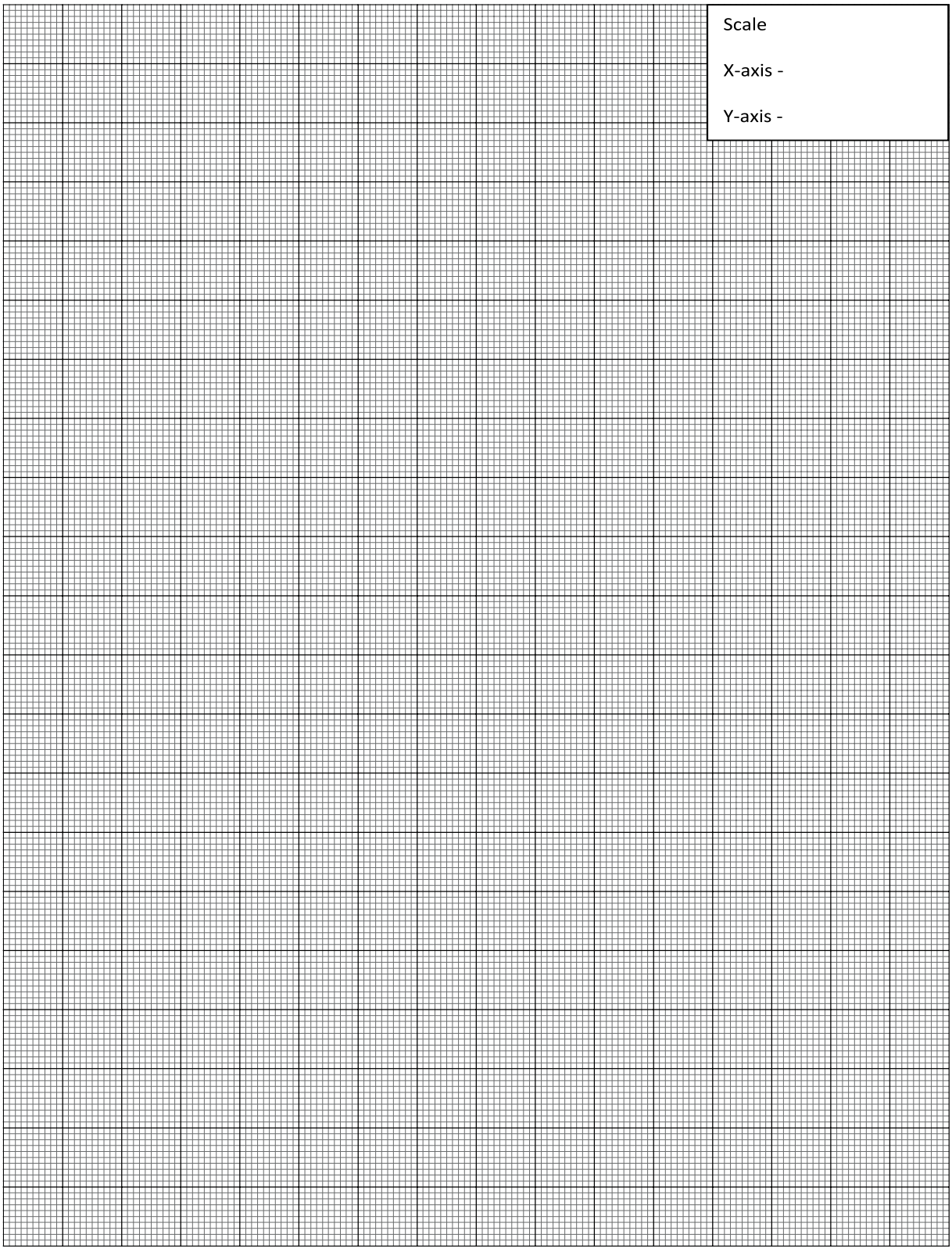
XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……
2. ……
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No.9: Identify the Terminals ofthe PNPand NPN Transistor

I Practical Significance

In industry, transistor has wide range of applications. Transistors are semiconductor devices used for applications like amplification of voltages, current and are also used in oscillator circuits and switches. In digital circuits they are used as switches. It is used in electronic equipment, computers, televisions, mobile phones, audio amplifiers, industrial control, and radio transmitters.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Testing of transistor
2. Identifications of terminals of BJT

IV Relevant Course Outcomes

Use BJT and FET in electronics circuits.

V Practical Outcome

Identify the terminals of the PNP and NPN transistor using Digital Multimeter and CRO

1. Measure the resistance between base and emitter.
2. Measure the resistance between base and collector.
3. Measure the resistance between emitter and collector.
4. Operate CRO in component testing mode.

VI Practical Skills

1. Identify type of transistor.
2. Test Different terminals of transistor.
3. Measurement Skills.

VII Relevant Affective domain related Outcomes

a. Handle components and equipment carefully.
b. Select instruments of required range.

VIII Minimum Theoretical Background

A transistor has two PN junctions, (a combination of two diodes connected back to back) one junction is forward biased and the other is reverse biased. The forward biased junction has a low resistance path whereas a reverse biased junction has a high resistance path. The weak signal is introduced in the low resistance circuit and output is taken from the high resistance circuit. Transistor has two junctions and 3 terminals, made of three

layers of N and P type materials. The three regions are emitter, base and collector. They are of 2 types of BJT (i) PNP and (ii) NPN.

An NPN transistor is composed of two N-type semiconductors separated by a thin section of P type. However, a PNP transistor is formed by two P-sections separated by a thin section of N-type as shown in Figure 1.

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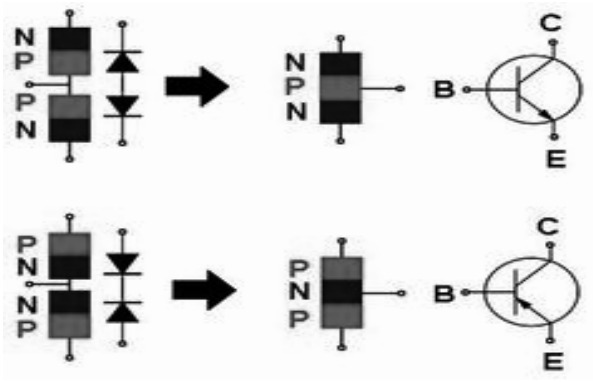

Figure 1: NPN,PNP Transistor construction and symbol

Identifying Transistor Terminals:

The transistors are available with various packages in the market. Consider about the TO-92 package. Keep the transistor such that the flat surface facing towards you as shown in the below figure:

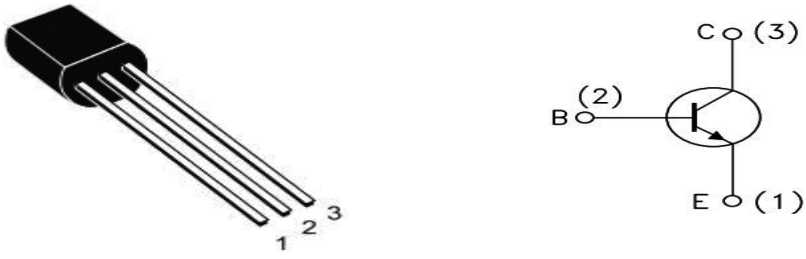

Figure 2: TO-92 package of transistor and its terminals

Now starting from left, mark like 1, 2 and 3. They are respectively

1. Emitter (E)
2. Base (B)
3. Collector(C)

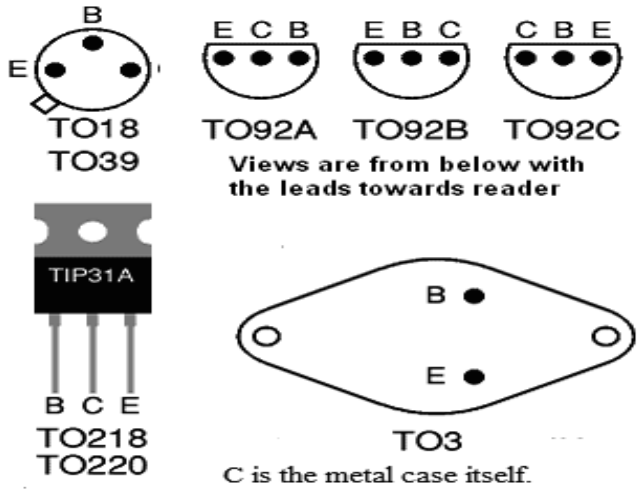

Figure 3: Emitter, base and collector leads for some case styles.

Both NPN and PNP transistor looks similar in physical appearance. We cannot differentiate by seeing them. We need a multimeter or CRO to identify the type of BJT.

Remember the following points:

1. The transistor internally has two diodes (NPN ≡ N - P - N ≡ NP Junction + PN Junction and PNP ≡ P - N - P ≡ PN Junction + NP Junction) i.e, Emitter to base is one PN junction (diode) and Base to collector another PN junction (diode).
2. In the diode mode, the multimeter will show the voltage when we connect the positive probe of the multimeter to the anode of the diode and negative probe to the cathode.
3. If the multimeter positive probe is connected to the cathode of the diode and the negative probe to the anode, then it will not give any voltage (showing zero).

Steps to identify the PNP type transistor:

1. Keep the DMM in the Diode mode.
2. Keep the positive probe to the pin-1 (Emitter) of the transistor and connect the negative probe to the center pin (Base). You will see some voltage in the DMM.
3. Similarly connect the negative probe to the center pin (Base) with respect to the pin-3 (collector). You will see some voltage in the DMM.
4. It will ensure that it is a PNP transistor. The logic behind this is, in PNP transistor Emitter (E) - P type material - Equivalent to anode of the diode Base (B) - N type material - Equivalent to cathode of the diode Collector(C) - P type material - Equivalent to anode of the diode
5. If the multimeter positive probe is connected to anode and negative probe is connected to cathode, then it will show voltage. If the connections are interchanged it will not show any value.
6. By operating CRO in component testing mode resistance between various terminals can be measured.

Steps to identify the NPN/PNP type transistor using Digital Multimeter: Method -1I

We can use this analogy to determine whether a transistor is of the PNP type or NPN type by testing its Resistance between the three different leads, Emitter, Base and Collector. By testing each pair of transistor leads in both directions with a multimeter will result in six tests in total with the expected resistance values in Ohm's given below.

1. Emitter-Base Terminals – The Emitter to Base should act like a normal diode and conduct one way only.
2. Collector-Base Terminals – The Collector-Base junction should act like a normal diode and conduct one way only.
3. Emitter-Collector Terminals – The Emitter-Collector should not conduct in either direction.

IX Circuit diagram

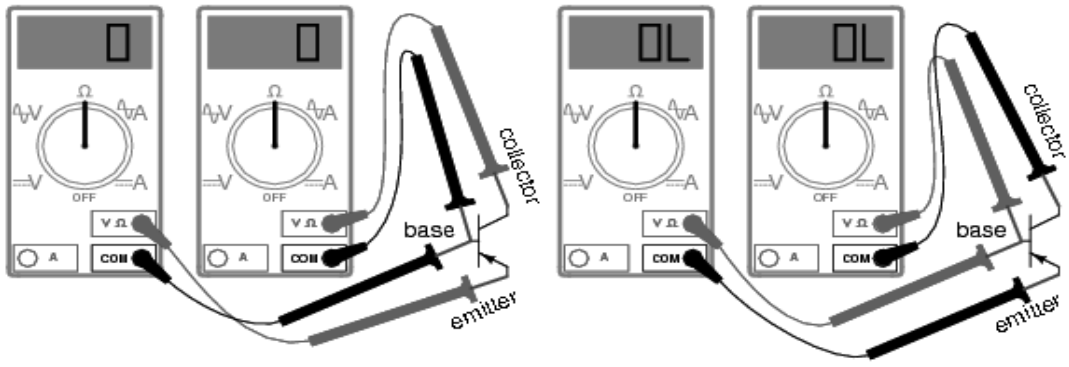

Figure 4: PNP transistor meter check: (a) forward B-E, B-C, resistance is low;
(b) reverse B-E, B-C, resistance is ∞.

X Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1	Digital Multimeter	3 1/2 digit display, 9999 counts digital multimeter measures: Vac, Vdc (1000V max) , Adc, Aac(10 amp max), Resistance (0 - 100 MΩ)	1	
2	CRO	20 MHz with component testing facility	1	
3	Transistors	Small Signal Transistor (TO-92 Package) BC547(NPN) BC557(PNP)	1 of each type	
4	Transistors	Power Transistors 2N2955(NPN) 2N3055(PNP)	1 of each type	

XI Procedure

Using Multimeter

1. Set the multimeter to its ohms range.
2. Measured the resistance between base and emitter.
3. Measured the resistance between base and collector.
4. Measured the resistance between emitter and collector.
5. Verify the above steps with following chart.

Between Transistor Terminals		PNP	NPN
Collector	Emitter	R_{HIGH}	R_{HIGH}
Collector	Base	R_{LOW}	R_{HIGH}
Emitter	Collector	R_{HIGH}	R_{HIGH}
Emitter	Base	R_{LOW}	R_{HIGH}
Base	Collector	R_{HIGH}	R_{LOW}
Base	Emitter	R_{HIGH}	R_{LOW}

XII Precautions

Select proper range in Digital Multimeter.

XIII Resources used (with major specifications)

S. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			

XIV Actual procedure followed

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……...
……...

XV Precautions followed

……..
……....

XVI Observations and Calculations:

Testing using Multimeter and CRO

1. R_{BE} = ---------- Resistance between emitter and base
2. R_{CB} = ---------- Resistance between Collector and base
3. Emitter R_{CE} = ---------- Resistance between Collector and

Calculations:

XVII Results

1. R_{BE} = …….
2. R_{CB} = …….
3. R_{CE} = …….

XVIII Interpretation of results

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XIX Conclusions

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……

XX 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. List the specification of transistor.
2. Why transistor is called bipolar device?
3. Why some transistors required heat sink?

[Space for Answers]

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XXI References / Suggestions for further Reading

1. http://www.electricalbasicprojects.com/how-to-identify-npn-and-pnp-transistor-using-multimeter/
2. http://www.nptel.ac.in/courses/117107095/lecturers/lecture_10/lecture10_page1.htm
3. https://www.allaboutcircuits.com/textbook/semiconductors/chpt-4/meter-check-transistor-bjt/
4. https://www.youtube.com/watch?v=ojdNj1lUJFE
5. https://www.youtube.com/watch?v=X7BT73KIHPk
6. https://www.youtube.com/watch?v=WmIgusHZyPc

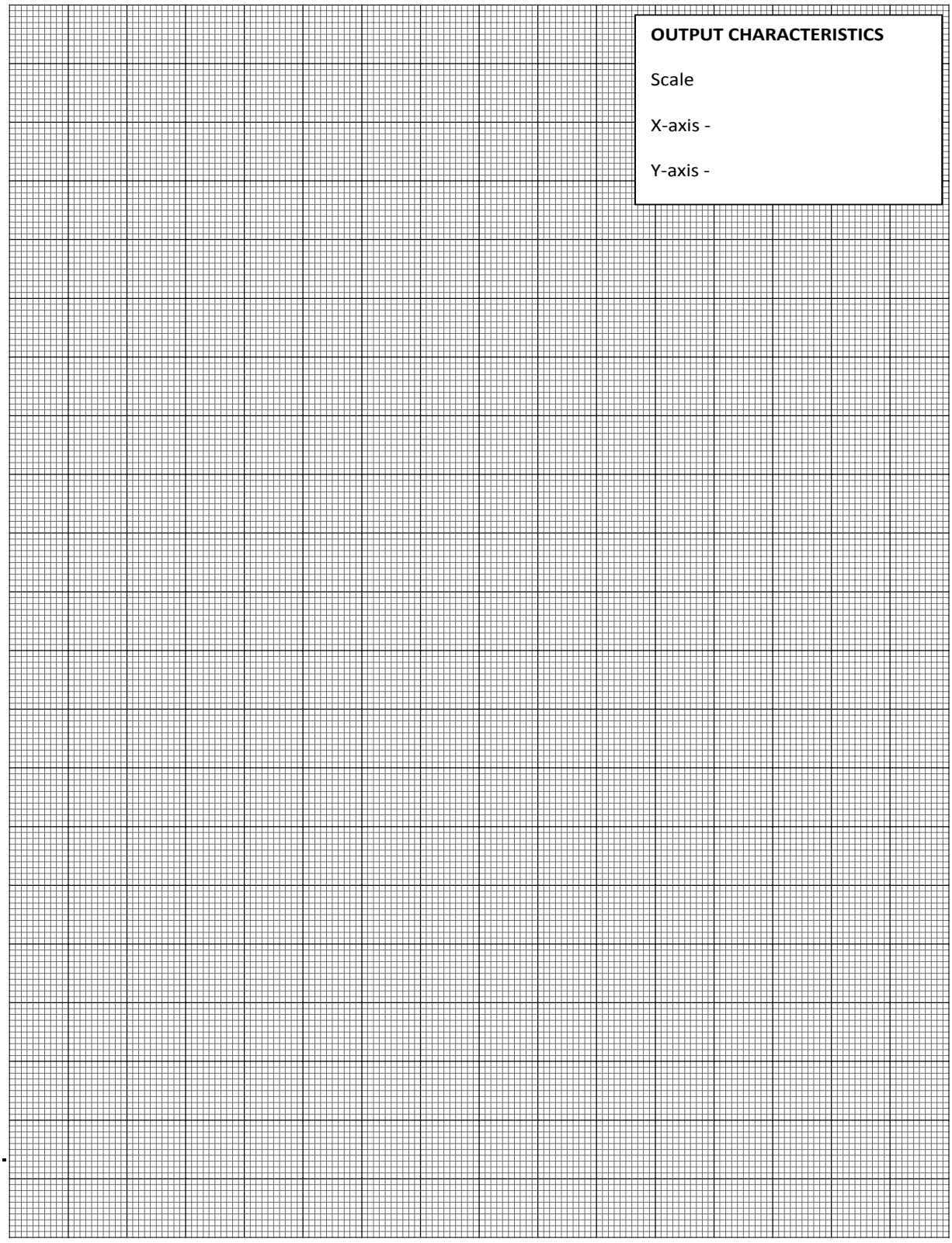
XXII Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Interpretation of result	15 %
6	Conclusions	05 %
7	Practical related questions	15 %
8	Submitting the journal in time	05%
	Total (25 Marks)	100 %

List of student Team Members

1. …….
2. …….
3. …….
4. …….

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


OUTPUT CHARACTERISTICS
Scale
X-axis -
Y-axis -

Practical No. 10: Build and Test Zener Voltage Regulator for the given Voltage.

I Practical Significance:

The Zener diode is like a general-purpose PN junction diode. When biased in the forward direction it behaves just like a normal PN junction diode, but when a reverse voltage is applied to it, the voltage remains constant for a wide range of currents.

Zener Breakdown: There is a limit for the reverse biasing voltage. Reverse biasing voltage can increase until the diode breakdown voltage reaches. This reverse biased voltage is called Zener *Breakdown voltage*. At this stage, maximum current will flow through the Zener diode.

The fact that the voltage across the diode in the breakdown region is almost constant turns out to be an important application of the Zener diode as a voltage regulator

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Component mounting skills.
3. Use DC Power supply to give different voltages.
4. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

Use DC regulated power supply.

V Practical Outcome

1. Test Zener voltage regulator for the given voltage.
2. Selection of Zener diode.
3. Determine load regulation and line regulation of a given Zener diode

VI Relevant Affective domain related Outcomes

Handle components and equipment carefully.

VII Minimum Theoretical Background

a) Line Regulation

In line regulation, series resistance and load resistance are fixed, only input voltage is changing. Output voltage remains the same as long as the input voltage is maintained above a minimum value.

Percentage of line regulation can be calculated by =

$$\frac{\Delta V_0}{\Delta V_{IN}} * 100$$

where V_0 is the output voltage and V_{IN} is the input voltage and ΔV_0 is the change in output voltage for a particular change in input voltage ΔV_{IN}.

b) Load Regulation

In this type of regulation, input voltage is fixed and the load resistance is varying. Output volt remains same, as long as the load resistance is maintained above a minimum value.
Percentage of load regulation =

$$\left[\frac{V_{NL}-V_{FL}}{V_{NL}}\right]*100$$

where V_{NL} is the null load resistor voltage (ie. remove the load resistance and measure the voltage across the Zener Diode) and V_{FL} is the full load voltage.

VIII Practical Circuit Diagram :

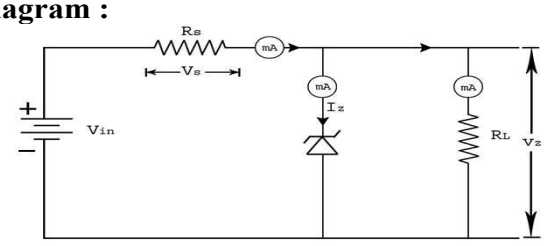


Figure 1: Zener Diode shunt regulator

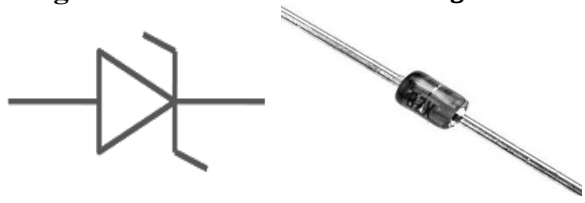


Figure 2: Zener Diode and its symbol

Courtesy: (**https://www.google.co.in/search?biw=998&bih=617&tbm=isch&sa=1&q=Zener+Diode**)

b. Actual Circuit used in laboratory

c. Actual Experimental set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Digital Multimeter	Digital Multimeter : 3 1/2 digit display.	2 No.	1. Digital Multimeter with diode testing facilities will be preferred. 2. In place of Digital Multimeter, DC Voltmeter and DC ammeter can be used.
2.	DC Regulated power supply	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1 No.	
3.	Voltmeter	0-20 V	1 No.	
4.	Ammeter	(0 - 200 mA, 0 - 200 μA)	2 No.	
5.	Bread board	5.5 CM X 17CM	1 No.	
6.	Diode	**1N4733 (or any other equivalent Zener diode)**	1 No.	
7.	Variable Load Resistor		1 No.	
8.	Resistor	1KΩ(0.5watts/0.25watts)	1 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

A) Line Regulation:

1. Connect the circuit as in figure 1.
2. Keep load resistance fixed value; vary DC input voltage from 5V to 15V.
3. Record the output voltage as a load voltage with high line voltage 'V_{HL}' and as a load voltage with low line voltage 'V_{LL}' in the observation table.

B) Load Regulation:

1. Keep input voltage constant say 10V, vary load resistance value.
2. Record no load voltage 'V_{NL}' for maximum load resistance value and full load voltage 'V_{FL}' for minimum load resistance value.
3. Calculate load regulation as per formula.
4. Sketch the graph for recorded readings.

XII Resources used (with major specifications)

S. No.	Equipment's /Components	Specification	Quantity
1.			
2.			
3.			
4.			
5.			

XIII Actual procedure followed

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XIV Precautions followed

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XV Observations and Calculations:

Table 1: Measurement of V_{in} and V_z

S. No.	Line Regulation ($R_L$constant) I_L=10(mA)		Load Regulation (V_{in}constant) V_{in}=10(V)	
	Input voltage $V_{in(VOLTS)}$	**Output voltage $V_{z(VOLTS)}$**	**Load current I_L(mA)**	**Output voltage $V_{z(VOLTS)}$**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Calculations:

Percentage of line regulation=

Percentage of load regulation=

XVI Results

Load Resistance	Output voltage $V_{z(VOLTS)}$	Load current I_L(mA)
R_L minimum		
R_L maximum		

XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Repeat the above experiment different Zener diode.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=n5_6b6-j0r4
2. https://www.youtube.com/watch?v=jG2YAtTWxv
3. https://www.youtube.com/watch?v=mfGEODPzTmc

XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. .....
2. .....
3. .....
4. .....

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -


Scale
X-axis -
Y-axis -

Practical No.11: Test The Various Blocks Of Regulated Dc Power Supply.

I Practical Significance

AC power is generated and transmitted from power plants. But the integrated circuits and electronic components used inside office automation equipment, factory automation equipment, and other electronics appliances cannot be operated with the AC voltage and they will be damaged by the high voltages. Stable DC voltage is required to operate these integrated circuits and electronic components. The device that converts commercial AC power to regulated DC power is called a regulated DC Power Supply. A regulated power supply converts unregulated AC into a constant DC. With the help of a rectifier it converts AC supply into DC. The output from the regulated power supply may be constant or variable, but is always DC. (Direct Current). The testing of regulated DC power supply is carried out to check whether the expected output is obtained at the output stage, else this will conclude that there is fault at the particular stage.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Use Digital multimeter to measure the voltage at output of each block.
3. Visual circuit inspection skill

IV Relevant Course Outcome(s)

Use DC regulated power supply.

V Practical Outcome

1. Component identification skills
2. Use Digital multimeter to measure the voltages.
3. Tracing actual circuit as per diagram.

VI Relevant Affective domain related Outcome(s)

1. Handle components and equipment carefully.
2. Select instruments of required range.

VII Minimum Theoretical Background

Testing of regulated DC power supply is used to troubleshoot the power supply. Testing is use to solve and eliminate the causes of fault. These faults cause voltage and current instability. Which can have a significant impact on equipment. The aim of a DC power supply is to provide the required level of DC power to the load using an AC supply at the input. The DC power supplies, consists of following major components /circuits:

- Input transformer: The input transformer is a step down transformer of required voltage and current rating.

- Rectifier: The rectifier converts AC to pulsating DC.
- Filter: It removes ripples.
- Voltage Regulator: It provides a constant output voltage irrespective of change in line voltage and load current.

VIII Block diagram:

a. Sample

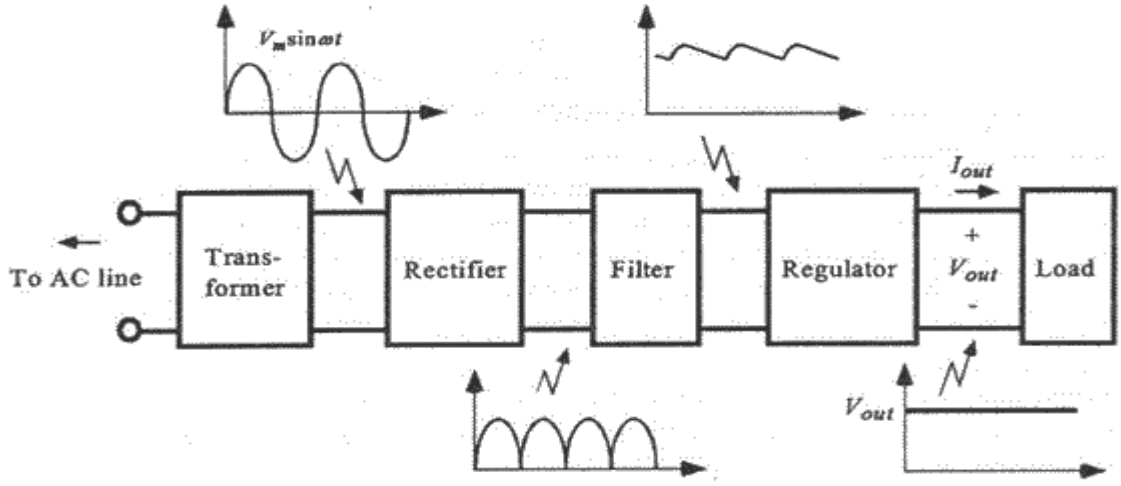

Figure1:Regulated power supply Block diagram

Courtesy: *(http://www.circuitstoday.com/wp-content/uploads/2009/10/Regulated-Power-Suppley-Block-Digram.jpg)*

b. Actual Circuit used in laboratory

c. Actual Experimental Set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2	1. Digital Multimeter with diode testing facilities will be preferred. 2. In place of Digital Multimeter, Voltmeter and ammeter can be used.
2.	CRO	25MHz Dual scope	1	
3.	DC regulated Power supply Trainer Kit		2	
4	Electric Tester		1	

X Precautions to be Followed

1. Before connecting the plug to the mains check, check the wires insulation.

XI Procedure

1. Use trainer kit of regulated DC power supply.
2. ON the AC supply.
3. Check and Sketch the nature of waveform using CRO:
   - at primary of the Transformer on CRO
   - at secondary of the Transformer on CRO
   - at output of rectifier.
   - at output of filter .
   - at output of regulator.
4. Draw all waveforms nature in the observation table.
5. Draw all waveforms nature on graph paper.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

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XIV Precautions Followed

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XV Observations and Calculations

Table 1: Output voltage and Output waveform.

S.No.	Stage	Output voltage (V)	Output waveform
1	Primary of Transformer		
2	Secondary of Transformer		
3	Output of Rectifier		
4	Output of Filter		
5	Output of Regulator		

Calculations: **Not Applicable**

XVI Results

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XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Measure the voltages at given different stages given in observation table using DMM.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://commons.wikimedia.org/wiki/File:Practical_Regulated_Power_Supply_Components.jpg#/media/File:Practical_Regulated_Power_Supply_Components.jpg
2. https://www.electrical4u.com/regulated-power-supply/
3. http://www.circuitstoday.com/regulated-power-supply

XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Interpretation of result	15 %
6	Conclusions	05 %
7	Practical related questions	15 %
8	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……
2. ……
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No.12:Find Out Faults at Different Stages of Regulated DC Power Supply.

I Practical Significance

AC power is generated and transmitted from power plants. AC power generation and transmission is easier and cheaper than DC supply transmission. But the integrated circuits and electronic components used inside office automation equipment, factory automation equipment, and other electronics appliances cannot be operated with the AC voltage and they will be damaged by the high voltages. Stable DC voltages are required to operate these integrated circuits and electronic components. The device that converts commercial AC power to regulated DC power is called a regulated DC Power Supply. A regulated power supply converts unregulated AC into a constant DC. With the help of a rectifier it converts AC supply into DC. The output from the regulated power supply may be constant or variable, but is always DC (Direct Current). The testing of regulated DC power supply is carried out to check whether the expected output is obtained at the output stage, else this will conclude that there is fault at the particular stage.

II Relevant Program Outcomes (POs)

- **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
- **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
- **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Use Digital multimeter to measure the voltage at output of each block
3. Fault finding skills.

IV Relevant Course Outcome(s)

- Use DC regulated power supply.

V Practical Outcome

1. Component identification skills
2. Use Digital multimeter to measure the voltages.
3. Circuit troubleshooting skills.

VI Relevant Affective domain related Outcome(s)

1. Handle components and equipment carefully.
2. Select instruments of required range.

VII Minimum Theoretical Background

Testing of regulated DC power supply is used to troubleshoot the power supply. Testing is use to solve and eliminate the causes of fault. These faults cause voltage and current instability. Which can have a significant impact on equipment. The aim of a DC power supply is to provide the required level of DC power to the load using an AC supply at the input. The DC power supply consists of following major components/circuits:

- Input transformer: The input transformer is a step down transformer.

- Rectifier: The rectifier converts AC to pulsating DC.
- Filter: It removes ripples.
- Voltage Regulator: It provides a constant output voltage irrespective of change in line and load voltage.

VIII Block diagram:

a. Sample

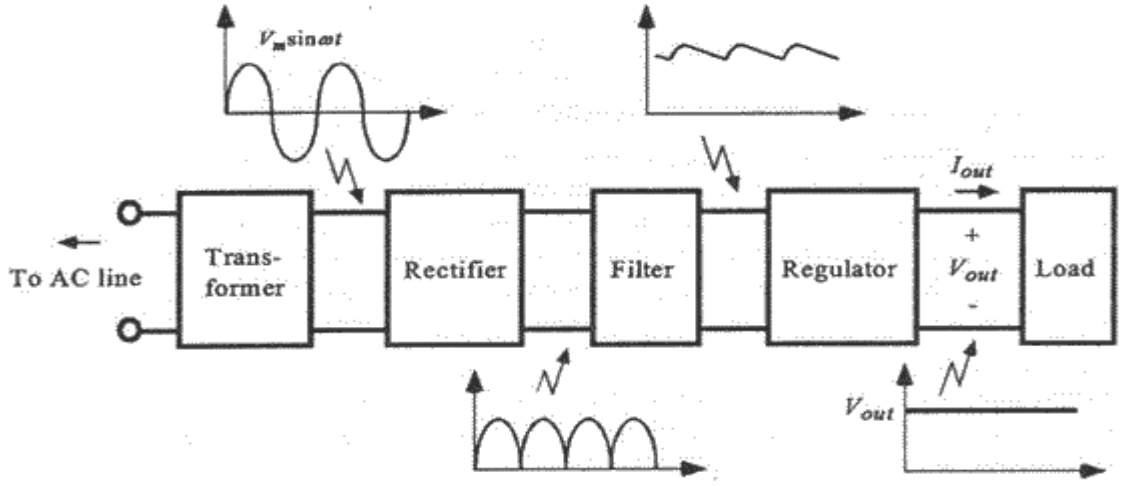

Figure1:Regulated power supply Block diagram

Courtesy: *(http://www.circuitstoday.com/wp-content/uploads/2009/10/Regulated-Power-Suppley-Block-Digram.jpg)*

b. Actual Circuit used in laboratory

c. Actual Experimental Set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2	1. Digital Multimeter with diode testing facilities will be preferred. 2. In place of Digital Multimeter, Voltmeter and ammeter can be used.
2.	CRO	25MHz Dual scope	1	
3.	DC regulated Power supply Trainer Kit		2	

X Precautions to be Followed

Before connecting the plug to the mains check, the insulation of wires.

XI Procedure

1. Use trainer kit of regulated DC power supply.
2. ON the AC supply.
3. Create faults at different stages, compare the observed output voltage with the expected output voltage at that stage and comment on the values.

XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

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XIV Precautions Followed

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XV Observations and Calculations

Table 1: Observe output voltage and fault.

S. No.	Create fault at Stage	Expected Output Voltage	Observed Output Voltage	Comment Related to Observed fault
1.				
2.				
3.				
4.				
5.				

Calculations: **Not Applicable**

XVI Results

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XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Measure the voltages at given different stages given in observation table using DMM.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://commons.wikimedia.org/wiki/File:Practical_Regulated_Power_Supply_Components.jpg#/media/File:Practical_Regulated_Power_Supply_Components.jpg
2. https://www.electrical4u.com/regulated-power-supply/
3. http://www.circuitstoday.com/regulated-power-supply

XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Interpretation of result	15 %
6	Conclusions	05 %
7	Practical related questions	15 %
8	Submitting the journal in time	05%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. ……
2. ……....
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 13: Troubleshoot given DC Regulated Power Supply.

I Practical Significance

Troubleshooting of an *electronic circuit* is a process of having a special outlook on components that comes out with remedies to repair it. The unexpected behavior exhibited by the *circuit* is due to improper locating or soldering of components, component damage due to aging, faults, overheat, and so on.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Component identification skills.
2. Use Digital multimeter to measure the voltage at output of each block.

IV Relevant Course Outcome(s)

- Use DC regulated power supply.

V Practical Outcome

1. Component identification skills
2. Use Digital multimeter to measure the voltages.

VI Relevant Affective domain related Outcome(s)

1. Handle components and equipment carefully.
2. Select instruments of required range.

VII Minimum Theoretical Background

Troubleshooting is a form of problem solving, often applied to repair failed products or processes on a machine or a system. It is a logical, systematic search for the source of a problem in order to solve it, and make the product or process operational again.

Troubleshooting approach consists of the following:

Step 1 -Physical Observation
(Locating different electronic components in different section)
Step 2 -Define Problem Area
Step 3 -Identify Possible Causes
Step 4 -Determine Most Probable Cause
Step 5-Test and Repair.

VIII Circuit diagram:

a. Sample

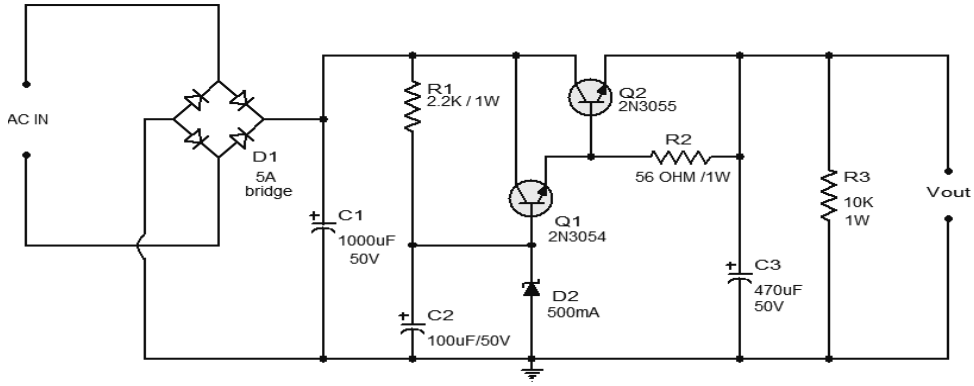


Figure1: Regulated power supply

Note: *This circuit is just a sample you can have any regulated power supply*

b. Actual Circuit used in laboratory

c. Actual Experimental Set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2	1. Digital Multimeter with diode testing facilities will be preferred. 2. In place of Digital Multimeter, Voltmeter and ammeter can be used.
2.	CRO	25MHz Dual scope	1	
3.	DC regulated Power supply Trainer Kit		2	

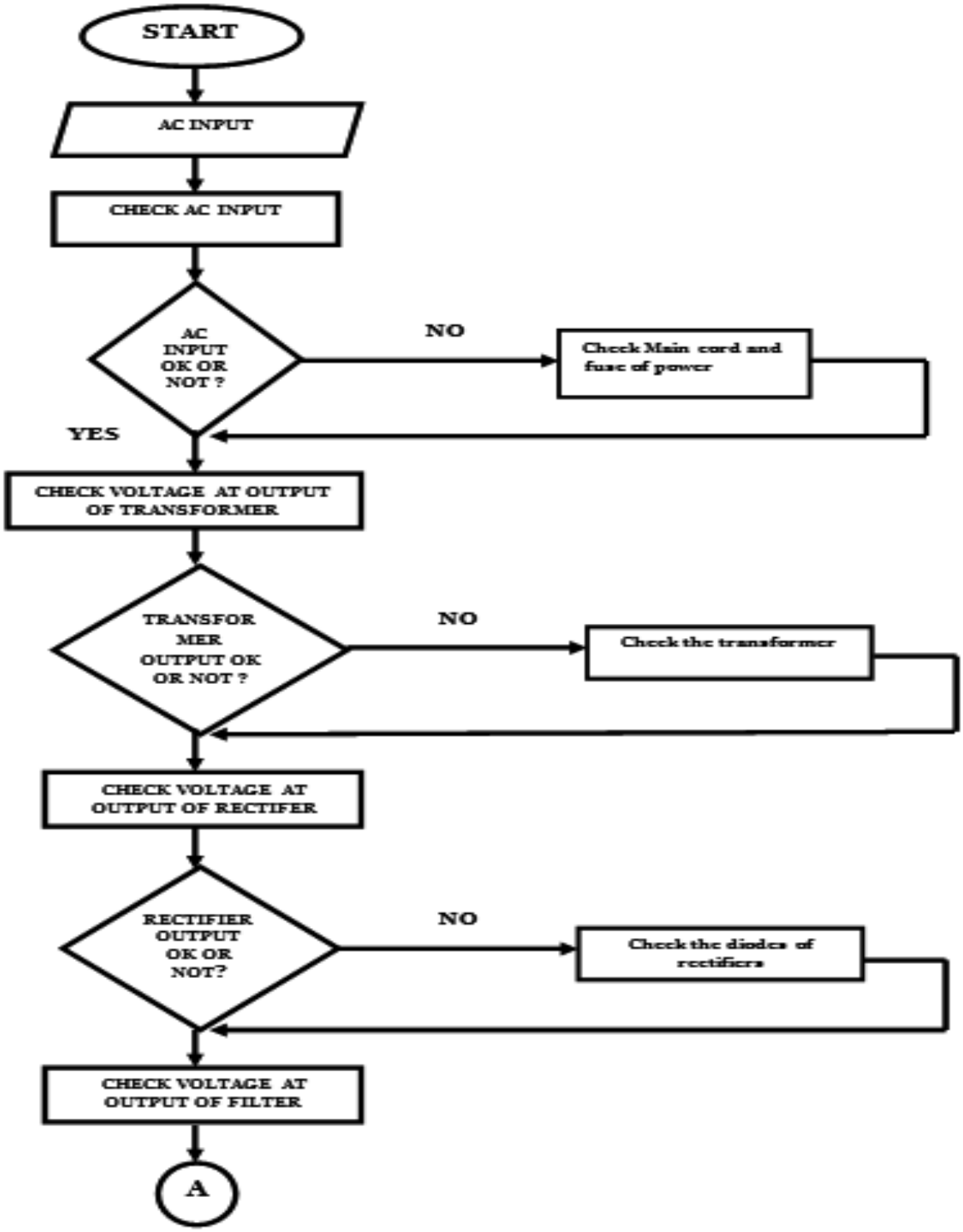
X Precautions to be Followed

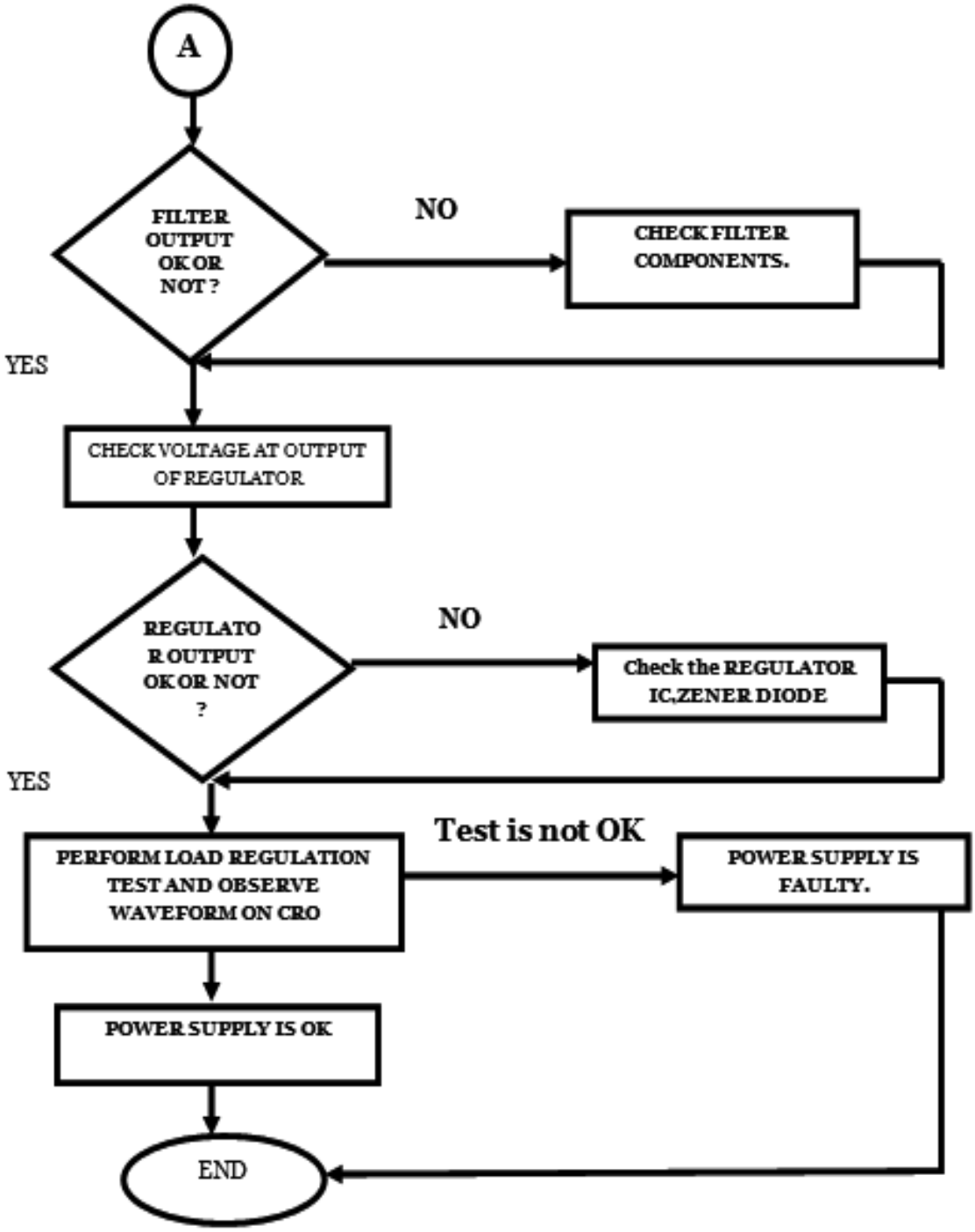
Before connecting the plug to the mains check, the wires are properly insulated.

XI Procedure

For trouble shooting of given power supply follow the given flow chart:
Follow the given flow chart for troubling shooting the given power supply.

1. Do the physical observations of different section of the given power supply.
2. Draw the circuit diagram of the given power supply and mark test point as per the flow chart.
3. Go on testing each section of given circuit from input side to output side and test output.
4. Record the voltage and sketch waveforms at all check points in the table.
5. Compare the voltage value at given point with expected value, check waveform at given point and then identify the fault in given supply.


START
AC INPUT
CHECK AC INPUT
AC INPUT OK OR NOT ?
NO
Check Main cord and fuse of power
YES
CHECK VOLTAGE AT OUTPUT OF TRANSFORMER
TRANSFORMER OUTPUT OK OR NOT ?
NO
Check the transformer
CHECK VOLTAGE AT OUTPUT OF RECTIFER
RECTIFIER OUTPUT OK OR NOT?
NO
Check the diodes of rectifier
CHECK VOLTAGE AT OUTPUT OF FILTER
A



XII Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

XIII Actual Procedure Followed

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XIV Precautions Followed

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XV Observations and Calculations

Table 1: Observed waveforms.

S.No.	Test Points	Standard value	Measured value	Observed waveform

Calculations: Not Applicable

XVI Results

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XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

Repeat the experiment with different faults.

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://commons.wikimedia.org/wiki/File:Practical_Regulated_Power_Supply_Components.jpg#/media/File:Practical_Regulated_Power_Supply_Components.jpg
2. https://www.electrical4u.com/regulated-power-supply/
3. http://www.circuitstoday.com/regulated-power-supply

XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Interpretation of result	15 %
6	Conclusions	05 %
7	Practical related questions	15 %
8	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……...
2. ……
3. ……
4. ……

Marks Obtained			**Dated signature of Teacher**
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 14: Test the Performance of Regulator IC'S: IC'S 78XX, 79XX.

I Practical Significance

In the industry and home appliances three terminal regulators are used. They give fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. Use of 78xx and 79xx will help students to acquire necessary practical skills related to regulators.

II Relevant Program Outcomes (POs)

1. PO 1. **Basic knowledge:** Apply knowledge of basic mathematics, sciences and basic engineering to solve the broad-based Electrical engineering problems.
2. PO3 - **Experiments and practice:**Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.

III Competency and Practical Skills

This practical is expected to develop the following skills for the industry identified competency:'**Use electronic components and circuits in electrical equipment.**'

1. Select relevant IC for regulation
2. Measure and record the practical data.
3. Identify various electronic elements

IV Relevant Course Outcome(s)

Use DC regulated power supply

V Practical Outcome

1. Test the performance of Ic 78xx, 79xx:
2. Measure output voltage for 78xx.
3. Measure output voltage for 79xx

VI Minimum Theoretical Background

IC 78XX is positive series of regulators. For ICs within the 78xx family, the xx is replaced with two digits, indicating the output voltage for example, the 7805 has a 5-volt output, while the 7812 produces 12 volts. The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. The LM78XX series is available in an aluminum TO-3 package which will allow over 1.0A load current if adequate heat sinking is provided. Current limiting is included to limit the peak output current to a safe value. Safe area protection for the output transistor is provided to limit internal power dissipation. If internal power dissipation becomes too high for the heat sinking provided, the thermal shutdown circuit takes over preventing the IC from overheating. Voltage Range are LM7805C 5V; LM7812C 12V ; LM7815C 15V.

The LM79XX series of 3-terminal regulators is available with fixed output voltages of 5V, 8V, 12V, and 15V. These devices need only one external component, i.e. compensation capacitor at the output. The LM79XX series is packaged in the TO-220 power package and is capable of supplying 1.5A of output current.

VII Practical set-up / Circuit diagram

1) Positive voltage regulator

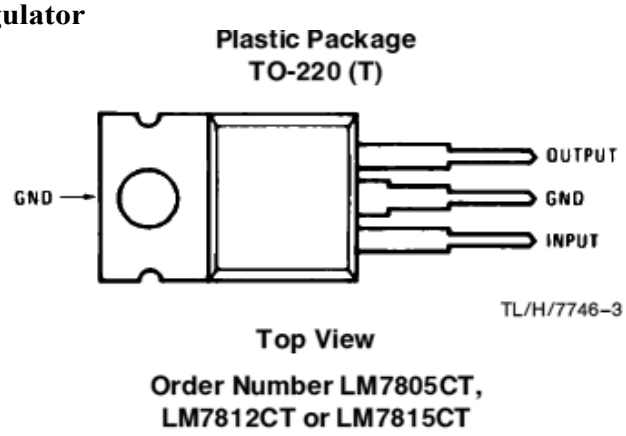

Figure 1: Pin Diagram of IC 78xx

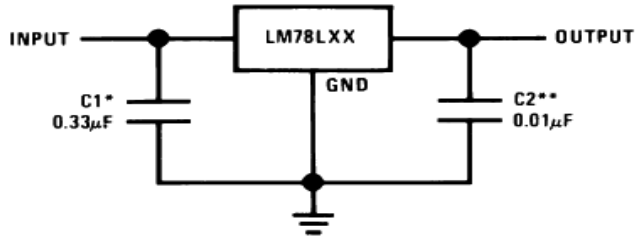

Figure 2: IC 78xx as Positive voltage regulator

2) Negative voltage regulator

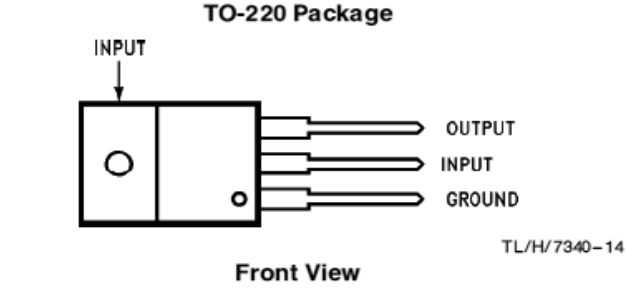

Figure 3: Pin Diagram of IC 79xx

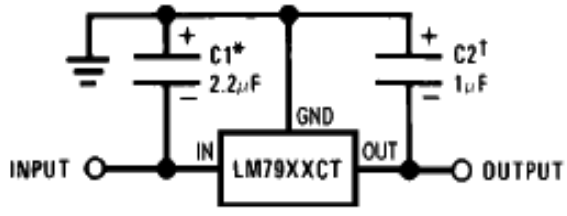

Figure 4: IC 79xx as Negative voltage regulator

VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	IC 7805, 7812, 7815	LM78L05 in micro SMD package n Output voltage tolerances of ±5% over the temperature range Output current of 100mA Internal thermal overload protection	2 Each
2.	IC 7905, 7912, 7915	Thermal, short circuit and safe area protection, High ripple rejection, 1.5A output current, 4% tolerance on preset output voltage	2 Each
3.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2
4.	Voltmeter	0-20 V	1
5.	Breadboards	General Purpose Breadboards	1
6.	Capacitors	0.01µF, 0.33 µF, 2.2 µF, 1 µF	1

IX Precautions to be Followed

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.

X Procedure

1. Connect circuit on General Purpose Breadboards
2. Apply unregulated DC power supply.
3. Measure input voltage with voltmeter or Multimeter
4. Measure output voltage with voltmeter or Multimeter

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Quantity	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

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

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XIII Precautions Followed

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……
……

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

1) Positive voltage regulator

Sr. No	IC Used	Input DC Voltage	Output DC Voltage
1	7805		
2	7805		
3	7805		
4	7812		
5	7812		
6	7812		
7	7815		
8	7815		
9	7815		

1) Negative voltage regulator

Sr. No	IC Used	Input DC Voltage	Output DC Voltage
1	7905		
2	7905		
3	7905		
4	7912		
5	7912		
6	7912		
7	7915		
8	7915		
9	7915		

XV Results

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

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

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XVIII 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. Draw circuit sketch that will give positive output equals to 5V, !2, 15 if input voltage source is around 20V?
2. Can we give AC input to IC 79xx
3. ……?
4. ……?

[Space for Answers]

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XIX References / Suggestions for further reading

1. www.alldatasheet.com/datasheet-pdf/pdf/9037/NSC/LM78XX.html
2. www.cedmagic.com/tech-info/data/lm78xx.pdf
3. https://www.youtube.com

XX Suggested Assessment Scheme

The given performance indicators should serve as a guideline for assessment regarding process and product related marks:

Performance indicators		Weightage
Process related: 15 Marks		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related: 10 Marks		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. ……...
2. ……....
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 15: Test the Performance of IC 723 as Regulator.

I Practical Significance:

Voltage regulators are used to compensate for voltage fluctuations in main power as well as load current variation. Voltage regulators are used in industries as well as in domestic applications such as Air Condition, TV, and Refrigerators in order to protect them from fluctuating input voltage. In this practical students will sketch line regulation characteristics of given IC 723.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment '**

1. Component identificationskills.
2. Component mountingskills.
3. Use DC Power supply to give different voltages.
4. Use Digital multimeter to measure the voltage and current.

IV Relevant Course Outcomes

- Use DC regulated power supply.

V Practical Outcome

1. Test the performance of IC 723 as Regulator.
2. Measure line regulation.

VI Relevant Affective domain related Outcome(s)

- Handle components and equipment carefully.

VII Minimum Theoretical Background

The 723 voltage regulator is commonly used for series voltage regulator applications. It can be used as both positive and negative voltage regulator. LM723 IC can also be used as a temperature controller, current regulator or shunt regulator and it is available in both Dual-In-Line and Metal Can packages.

Features of 723 Voltage Regulator

- 150 mA output current without external pass transistor
- Output currents in excess of 10A possible by adding external transistors
- Input voltage ranges from 9.5 to 40V.
- Output voltage adjustable from 2V to 37V
- Can be used as either a linear or a switching regulator
- Reference voltage Vref = 6.8V to 7.5V.
- Line regulation = 0.5% Vo = 0.001%Vo.

- Load regulation 0.6% Vo = 0.003% Vo.
- Short circuit current limit Isc = 65mA at Rsc = 10Ω and Vo = 0.
- Quiescent current drain is 3.5mA, typically 1.3mA.

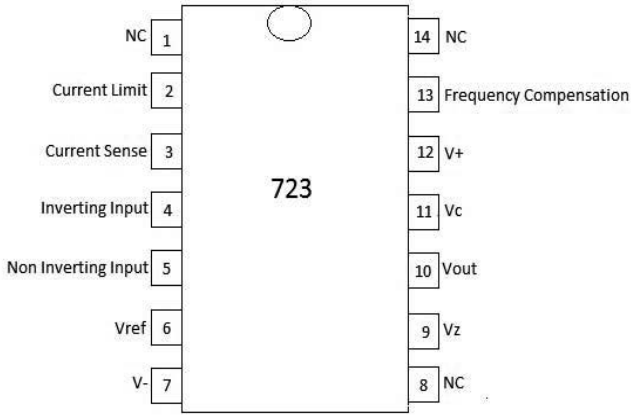

Figure 1: Pin configuration of IC LM723

Courtesy: https://electrosome.com/wp-content/uploads/2012/12/723-Voltage-Regulator-Pin-Diagram.jpg

Block diagram of IC 723.

Includes, voltage reference source, error amplifier, a series pass transistor and a current limit transistor all are included in 14 pin DIP package. It has temperature compensated 6.2 V Zener, which is biased with constant current source. A reference voltage amplifier generates the precise reference voltage in between 6.8 to 7.5 V. The output of error amplifier drives the series pass transistor Q1 to give output voltage. Transistor Q2 is connected internally to provide short circuit current limiting.

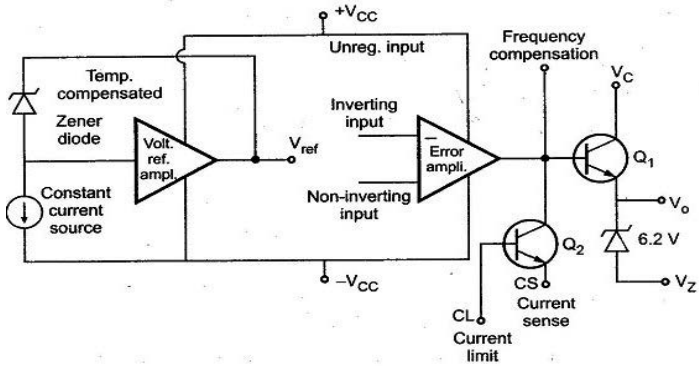

Figure 2: Block diagram of IC LM723

Courtesy: https://electrosome.com/wp-content/uploads/2012/12/723-Voltage-Regulator-Pin-Diagram.jpg

VIII Practical Circuit Diagram :

a) Sample

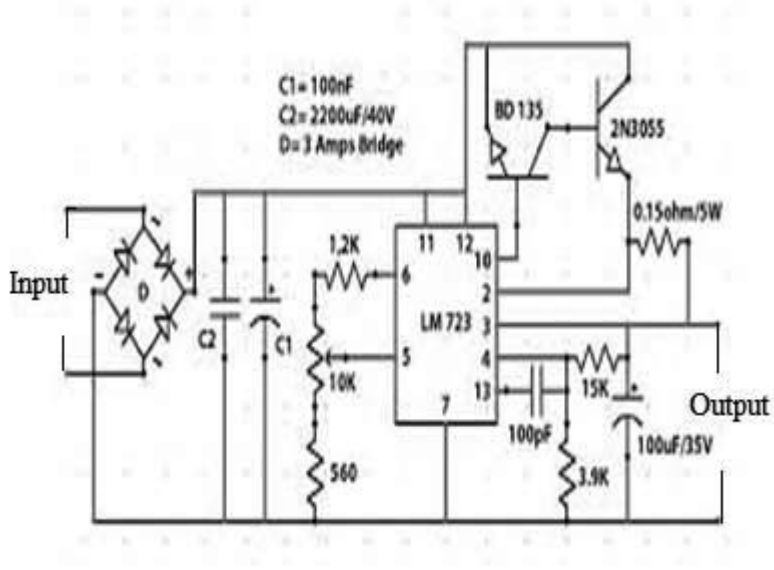

Figure 2: Circuit diagram of 723

b) Actual Circuit used in laboratory

c) Actual Experimental set up used in laboratory

IX Resources required

S. No.	Instrument /Components	Specification	Quantity	Remarks
1.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2	In place of digital multimeter we can use analog voltmeter.
2.	DC Regulated power supply	Variable DC power supply 0- 30V, 2A, SC protection, display for voltage and current.	1	
3.	Bread board	5.5 CM X 17CM	1	
4.	IC 723	LM 723	1	
5.	Resistor	1.2KΩ, 560 Ω,3.9 KΩ, 15 KΩ,0.15Ω/5W,10KΩ variable resistor	6	
6.	Capacitor	100 pF,100 Nf,100 μF,2200 μF.	4	
7.	Transistor	2N3055, BD135	2	
8.	Connecting wires	Single strand Teflon coating (0.6mm diameter)	As per requirement.	

X Precautions

1. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
2. Connect digital multimeter in correct polarities as shown in the circuit diagram.

XI Procedure

1. Select components and test it with multimeter.
2. Mount components on breadboard as per circuit diagram.
3. Connect dc power supply at the input.
4. Connect multimeter at the output.
5. Vary input voltage by varying dc supply till constant output voltage is obtained.
6. Note down the corresponding output voltage.
7. Tabulate input and output voltage in observation table.
8. Plot a graph of input dc voltage versus output voltage.

XII Resources used (with major specifications)

S. No.	Instrument /Components	Specification	Quantity
1.			
2.			
3.			
4.			
5.			

XIII Actual procedure followed

……
……
……

XIV Precautions followed

……
……

XV Observations and Calculations:

Table 1: Measurement of V_{in} and Vo for Line Regulation

S.No.	Input Voltage (Vin)	Output Voltage (Vo)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Calculations: Line Regulation =$\Delta V_{out}/\Delta V_{in}$

XVI Results

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XVII Interpretation of results

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XVIII Conclusions

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XIX Practical related Questions

1. State the difference between low voltage and high voltage regulator?
2. What are various protection circuits used in regulator
3. What is foldback current limiting?

[Space for Answers]

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XX References / Suggestions for further Reading

1. https://www.youtube.com/watch?v=veXShWaCliA
2. https://www.youtube.com/watch?v=tNqT7vCDswk

XXI Assessment Scheme

Performance indicators		Weightage
Process related (15 Marks)		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related (10 Marks)		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……..……..
2. ……..….
3. ……
4. ……

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	


Scale
X-axis -
Y-axis -

Practical No. 16: Test the Performance of Given Logic Gate ICS

I Practical Significance

Digital IC gates are used in various electronics circuits, such as in DC drives or AC drives controlling cards. Study of basic gates is essential. Basic logic gates are implemented as small-scale integrated circuits (SSICs) or as part of more complex medium scale (MSI) or very large-scale (VLSI) integrated circuits.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Measure and record the practical data.
2. Identify various electronic elements
3. Identify logic gates in electronics circuits

IV Relevant Course Outcome(s)

Use of logic gates in electronics circuits

V Practical Outcome

Test the performance of logic gates

VI Minimum Theoretical Background

A logic gate is a basic building block of a digital circuit. Most logic gates have two inputs and one output. At any given moment, every terminal is in one of the two binary conditions low (0) or high (1), represented by different voltage levels. The logic state of a terminal can, and generally does, change often, as the circuit processes data. In most logic gates, the low state is approximately zero volts (0 V), while the high state is approximately five volts positive (+5 V). IC 74XX series is digital logic integrated circuits. They are TTL (Transistor-Transistor logic) integrated circuits.

1 **OR Gate**: OR gate produces an output as one or high, when any one or all its inputs are equals to one; otherwise the output is zero. This gate can have minimum two inputs but output is always one. Its output is zero when only all input are zero.

2 **AND Gate**: AND gate produces an output as one, when all its inputs are equals to one; otherwise the output is zero. This gate can have minimum 2 inputs but output is always one. Its output is zero when any input is zero.

3 **NOT Gate**: NOT gate produces the complement of its input. This gate is also called an Inverter. It always has one input and one output. Its output is zero when input is one and output is one when input is zero.

4 **NAND Gate**: NAND gate is actually a series connection of AND gate with NOT gate. If we connect the output of an AND gate to the input of a NOT gate, this combination will work as NOT-AND or NAND gate. Its output is one when any or all inputs are zero, otherwise output is one.

5 **NOR Gate**: NOR gate is actually a series connection of OR gate with NOT gate. If we connect the output of an OR gate to the input of a NOT gate, this combination will work as NOT-OR or NOR gate. Its output is zero when any one or all inputs are one.

6 **Exclusive OR (X-OR) Gate**: This gate produces an output as one, when number of one's at its inputs is odd, otherwise output is zero. It has two inputs and one output.

VII Practical set-up / Circuit diagram

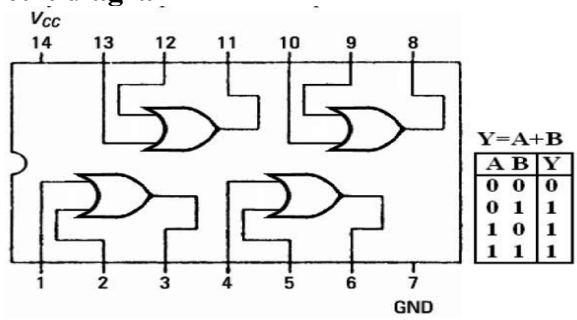

Figure 5: OR Gate IC 7432

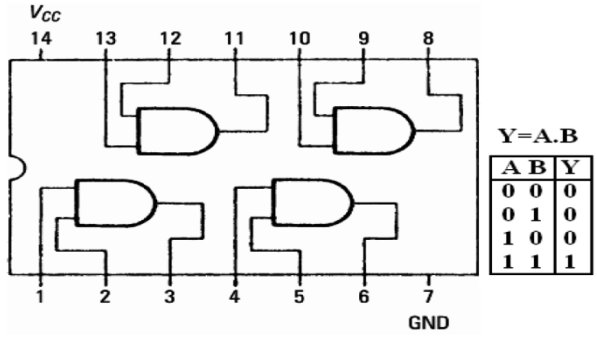

Figure 6: AND gate IC 7408

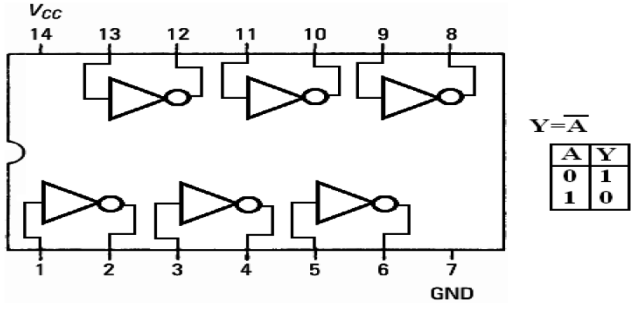

Figure 7: NOT Gate IC 7404

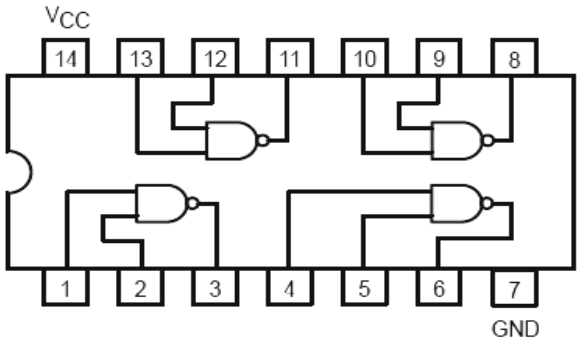

Figure 8: NAND Gate IC 7400

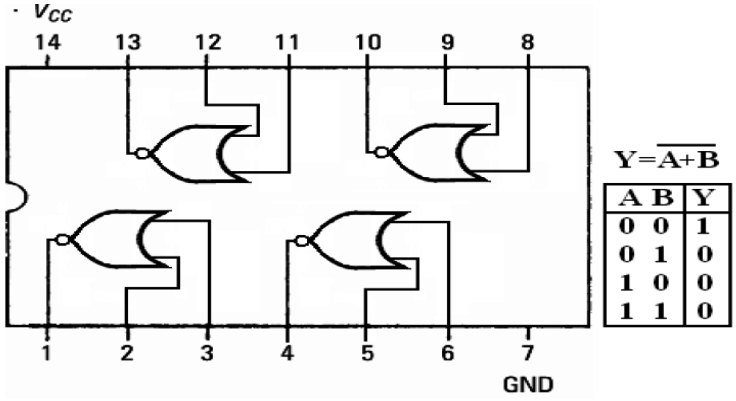

Figure 9: NOR Gate IC 7402

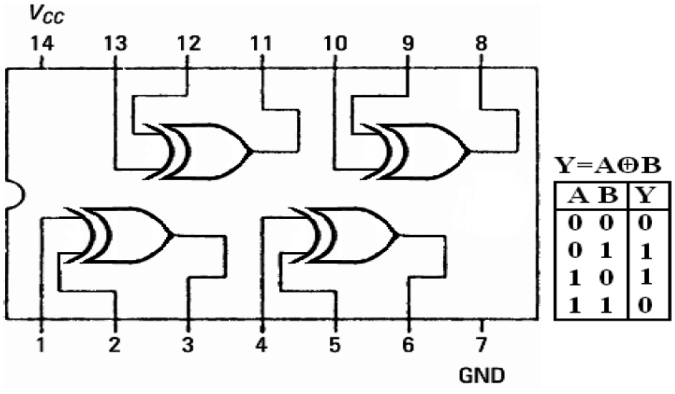

Figure 10: X-OR Gate IC 7486

VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1.	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2
2.	Breadboards	General Purpose Breadboards	1
3.	DC power supply	+5 V Fixed power supply	1
4.	IC	7486,7402,7400, 7404, 7432, 7408	1 Each
5.	LED	Red color 5 mm	1
6.	Connecting wires	Single strand 0.6 mm Teflon coating	As per requirement

IX Precautions to be Followed

Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.

X Procedure

1. Connect the inputs of any one logic gate to the logic sources
2. Observer/measure output to the logic indicator.
3. Apply various input combinations and observe output for each one.
4. Verify the truth table for each input/ output combination.
5. Repeat the process for all other logic gates.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Qty	Remarks (If any)
		Make	Details		
1.					
2.					
3.					

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

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XIII Precautions Followed

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

Sr. No	GATE	IC Number	Input 1	Input2	Output
1	OR Gate				
2	AND Gate				
3	NOT Gate				
4	NAND Gate				

5	NOR Gate				
6	Exclusive OR (X-OR) Gate				

XV Results

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……..

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

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……

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

……
……

XVIII 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. Convert NAND Gate into AND gate?
2. Can we convert OR gate into AND gate?
3. ……?
4. ……?

[Space for Answers]

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XIX References / Suggestions for further reading

1. www.alldatasheet.com/datasheet-pdf
2. http://www.electronics-tutorials.ws/logic/logic_1.html
3. https://academo.org/demos/logic-gate-simulator

XX Suggested Assessment Scheme

The given performance indicators should serve as a guideline for assessment regarding process and product related marks:

Performance indicators		Weightage
Process related: 15 Marks		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related: 10 Marks		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	**100 %**

Names of Student Team Members

1. ……..
2. ……...…….
3. ……
4. …….

Marks Obtained			Dated signature of Teacher
Process Related(15)	**Product Related(10)**	**Total (25)**	

Practical No. 17: Test the Performance of given Flip Flop ICS.

I Practical Significance

Digital IC gates are used in various electronics circuits. A flip-flop is a circuit that has two stable states and can be used to store information. A flip-flop is a bistable multi vibrator. The circuit can be made to change state by signals applied to one or more control inputs and will have one or two outputs.

II Relevant Program Outcomes (POs)

1. **Discipline knowledge:** Apply Electrical engineering knowledge to solve broad-based electrical engineering related problems.
2. **Experiments and practice:** Plan to perform experiments and practices to use the results to solve broad-based Electrical engineering problems.
3. **Engineering tools:** Apply relevant Electrical 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 electronic components and circuits in electrical equipment.'**

1. Measure and record the practical data.
2. Identify various electronic elements.
3. Identify flip-flop in electronics circuits

IV Relevant Course Outcome(s)

- Use of logic gates in electronics circuits.

V Practical Outcome

Test the performance of Flip Flop.

VI Minimum Theoretical Background

Digital circuits have many combinations of logic circuits. They are classified as either combinational or sequential. The output of combinational circuits depends only on the current inputs. In contrast, sequential circuit depends not only on the current value of the input but also upon the internal state of the circuit. Basic building blocks (memory elements) of a sequential circuit are the flip-flops (FFs). The FFs change their output state depending upon inputs at certain interval of time synchronized with some clock pulse applied to it. Usually any flip-flop has normal inputs, present state Q(t) as circuit inputs and two outputs; next state Q(t+1) and its complementary value; .

VII Practical set-up / Circuit diagram

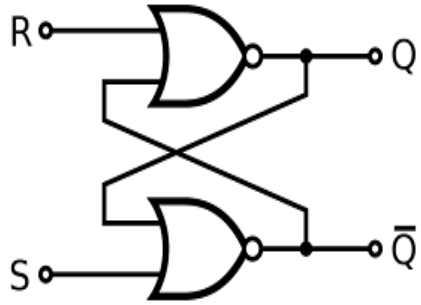
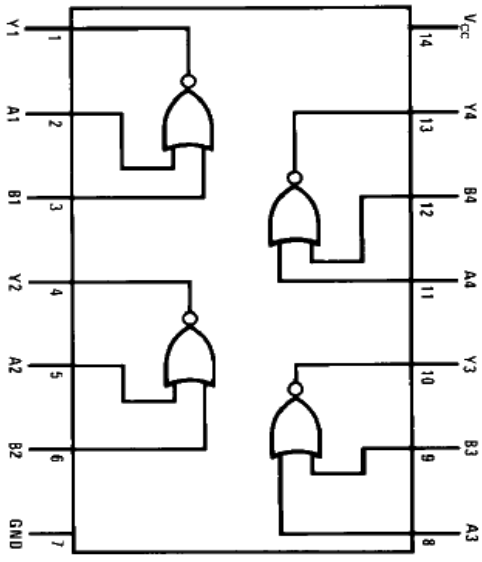
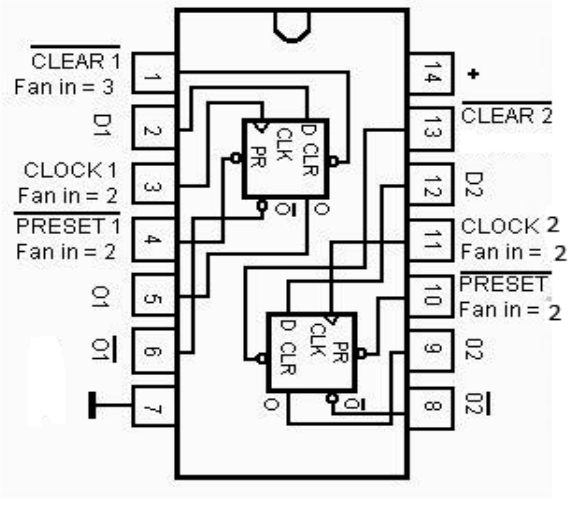


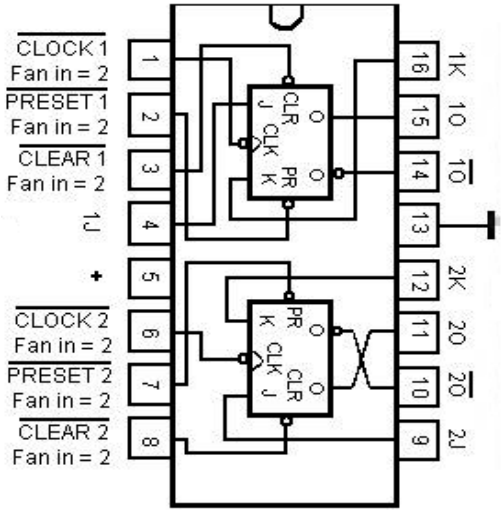
Figure 11: Logic diagram of SR FF



IC 7402 NOR Gate



D FF 7474



IC 7476 JK FF

VIII Resources Required

S. No.	Name of Resource	Suggested Broad Specification	Quantity
1	Digital Multimeter	Digital Multimeter: 3 1/2 digit display.	2
2	Breadboards	General Purpose Breadboards	1
3	IC	7474, 7476, 7402	1 Each
4	DC power supply	+5V DC power supply	1

IX Precautions to be Followed

Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.

X Procedure

1. Implement active high SR flip flop using IC's and breadboard and complete the truth table.
2. Implement D, JK Flip-Flops using IC's and breadboard/kit and complete the truth table.

XI Resources Used

S. No.	Name of Resource	Broad Specifications		Qty	Remarks (If any)
		Make	Details		
1					
2					
3					

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

……

……

XIII Precautions Followed

……

……

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

Table 1:-**SR flip-flop**

S	R	Q(t+1)	Comment	
0	0		NC	
0	1		Reset	
1	0		Set	
1	1		undefined	

Table 2:- **D flip-flop**

CLK	D	Q(t+1)	comment	
0	X		NC	
1	0		Reset	
1	1		Set	

Table 3:-J-K flip-flop

CLK	J	K	Q(t+1)	comment	
0	X	X		NC	
1	0	0		NC	
1	0	1		Reset	
1	1	0		Set	
1	1	1		Toggle	

XV Results

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……

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

……
……

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

……
……

XVIII 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. Convert SR FF Gate into T gate?
2. ……?
3. ……?

[Space for Answers]

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XIX References / Suggestions for further reading

1. www.alldatasheet.com/datasheet-pdf
2. http://www.electronics-tutorials.ws
3. https://academo.org/demos/logic-gate-simulator

XX Suggested Assessment Scheme

Performance indicators		Weightage
Process related: 15 Marks		**60%**
1	Handling of the components	10 %
2	Identification of component	20 %
3	Measuring value using suitable instrument	20 %
4	Working in team	10 %
Product related: 10 Marks		**40%**
5	Calculate theoretical values of given component	10 %
6	Interpretation of result	05 %
7	Conclusions	05 %
8	Practical related questions	15 %
9	Submitting the journal in time	05%
	Total (25 Marks)	100 %

Names of Student Team Members

1. ……...
2. ...…….
3. ……
4. ……...

Marks Obtained			Dated signature of Teacher
Process Related (15 Marks)	**Product Related (10 Marks)**	**Total (25 Marks)**	

List Of Laboratory Manuals Developed by MSBTE

First Semester:

1	Fundamentals of ICT	22001
2	English	22101
3	English Work Book	22101W
4	Basic Science (Chemistry)	22102
5	Basic Science (Physics)	22102

Second Semester:

1	Bussiness Communication Using Computers	22009
2	Computer Peripherals & Hardware Maintenace	22013
3	Web Page Design with HTML	22014
4	Applied Science (Chemistry)	22202
5	Applied Science (Physics)	22202
6	Applied Machines	22203
7	Basic Surveying	22205
8	Applied Science (Chemistry)	22211
9	Applied Science (Physics)	22211
10	Fundamental of Electrical Engineering	22212
11	Elements of Electronics	22213
12	Elements of Electrical Engineering	22215
13	Basic Electronics	22216
14	'C' programming Language	22218
15	Basic Electronics	22225
16	Programming in "C"	22226
17	Fundamentals of Chemical Engineering	22231

Third Semester:

1	Applied Multimedia Techniques	22024
2	Advanced Serveying	22301
3	Highway Engineering	22302
4	Mechanics of Structures	22303
5	Building Construction	22304
6	Concrete Technology	22305
7	Strength Of Materials	22306
8	Automobile Engines	22308
9	Automobile Transmission System	22309
10	Mechanical Operations	22313
11	Technology Of Inorganic Chemicals	22314
12	Object Oriented Programming Using C++	22316
13	Data Structure Using 'C'	22317
14	Computer Graphics	22318
15	Database Management System	22319
16	Digital Techniques	22320
17	Principles Of Database	22321
18	Digital Techniques & Microprocessor	22323
19	Electrical Circuits	22324
20	Electrical & Electronic Measurment	22325
21	Fundamental Of Power Electronics	22326
22	Electrical Materials & Wiring Practice	22328
23	Applied Electronics	22329
24	Electrical Circuits & Networks	22330
25	Electronic Measurments & Instrumentation	22333
26	Principles Of Electronics Communication	22334
27	Thermal Engineering	22337
28	Engineering Matrology	22342
29	Mechanical Engineering Materials	22343
30	Theory Of Machines	22344

Fourth Semester:

1	Hydraulics	22401
2	Geo Technical Engineering	22404
3	Chemical Process Instrumentation & Control	22407
4	Fluid Flow Operation	22409
5	Technology Of Organic Chemicals	22410
6	Java Programming	22412
7	GUI Application Development Using VB.net	22034
8	Microprocessor	22415
9	Database Managment	22416
10	Electric Motors And Transformers	22418
11	Industrial Measurements	22420
12	Digital Electronics And Microcontroller Applications	22421
13	Linear Integrated Circuits	22423
14	Microcontroller & Applications	22426
15	Basic Power Electronics	22427
16	Digital Communication Systems	22428
17	Mechanical Engineering Measurments	22443
18	Fluid Mechanics and Machinery	22445
19	Fundamentals Of Mechatronics	22048
20	Guidelines & Assessment Manual for Micro Projects & Industrial Training	22049

Fifth Semester:

1	Network Management & Administration	17061
2	Solid Modeling	17063
3	CNC Machines	17064
4	Behavioral Science(Hand Book)	17075
5	Behavioral Science (Assignment Book)	17075
6	Windows Programming using VC++	17076
7	Estimation and Costing	17501
8	Public Health Engineering	17503
9	Concrete Technology	17504
10	Design of Steel Structures	17505
11	Switchgear and Protection	17508
12	Microprocessor & Application	17509
13	A.C. Machines	17511
14	Operating System	17512
15	Java Programming	17515
16	System Programming	17517
17	Communication Technology	17519
18	Hydraulic & Pneumatics	17522
19	Advanced Automobile Engines	17523
20	Basic Electrical & Electronics	17524
21	Measurement and Control	17528
22	Power Engineering	17529
23	Metrology & Quality Control	17530
24	Computer Hardware & Networking	17533
25	Microcontroller	17534
26	Digital Communication	17535
27	Control System & PLC	17536
28	Audio Video Engineering	17537
29	Control System	17538
30	Industrial Electronics and applications	17541
31	Heat Transfer Operations	17560
32	Chemical Process Instrumentation & control	17561

Sixth Semester:

1	Solid Modeling	17063
2	Highway Engineering	17602
3	Contracts & Accounts	17603
4	Design of R.C.C. Structures	17604
5	Industrial Fluid Power	17608
6	Design of Machine Elements	17610
7	Automotive Electrical and Electronic Systems	17617
8	Vehicle Systems Maintenance	17618
9	Software Testing	17624
10	Advanced Java Programming	17625
11	Mobile Computing	17632
12	System Programing	17634
13	Testing & Maintenance of Electrical Equipments	17637
14	Power Electronics	17638
15	Illumination Engineering	17639
16	Power System Operation & Control	17643
17	Environmental Technology	17646
18	Mass Transfer Operation	17648
19	Advanced Communication System	17656
20	Mobile Communication	17657
21	Embedded System	17658
22	Process Control System	17663
23	Industrial Automation	17664
24	Industrial Drives	17667
25	Video Engineering	17668
26	Optical Fiber & Mobile Communication	17669
27	Therapeutic Equipment	17671
28	Intensive Care Equipment	17672
29	Medical Imaging Equipment	17673

Pharmacy Lab Manual

First Year:

1	Pharmaceutics - I	0805
2	Pharmaceutical Chemistry - I	0806
3	Pharmacognosy	0807
4	Biochemistry and Clinical Pathology	0808
5	Human Anatomy and Physiology	0809

Second Year:

1	Pharmaceutics - II	0811
2	Pharmaceutical Chemistry - II	0812
3	Pharmacology & Toxicology	0813
4	Hospital and Clinical Pharmacy	0816

HEAD OFFICE

Secretary,
Maharashtra State Board of Technical Education
49, Kherwadi, Bandra (East), Mumbai - 400 051
Maharashtra (INDIA)
Tel: (022)26471255 (5 -lines)
Fax: 022 - 26473980
Email: -secretary@msbte.com
Web -www.msbte.org.in

REGIONAL OFFICES:

MUMBAI

Deputy Secretary (T),
Mumbai Sub-region,
2nd Floor, Govt. Polytechnic Building,
49, Kherwadi, Bandra (East)
Mumbai - 400 051
Phone: 022-26473253 / 54
Fax: 022-26478795
Email: rbtemumbai@msbte.com

PUNE

Deputy Secretary (T),
M.S. Board of Technical Education,
Regional Office,
412-E, Bahirat Patil Chowk,
Shivaji Nagar, Pune
Phone: 020-25656994 / 25660319
Fax: 020-25656994
Email: rbtepn@msbte.com

NAGPUR

Deputy Secretary (T),
M.S. Board of Technical Education
Regional Office,
Mangalwari Bazar, Sadar, Nagpur - 440 001
Phone: 0712-2564836 / 2562223
Fax: 0712-2560350
Email: rbteng@msbte.com

AURANGABAD

Deputy Secretary (T),
M.S. Board of Technical Education,
Regional Office,
Osmanpura, Aurangabad -431 001.
Phone: 0240-2334025 / 2331273
Fax: 0240-2349669
Email: rbteau@msbte.com