STATE BOARD OF TECHNICAL EDUCATION & TRAINING::AP, VIJAYAWADA

DIPLOMA IN ELECTRONICS & COMMUNICATIO ENGG.

III SEMESTER

ELECTRONIC CIRCUITS-I LABORATORY (EC-307)

MANUAL (AS PER C-20 CURRICULUM)

INTRODUCTION

1.0 INTRODUCTION

The Curriculum of Technical Education should invariably provide for knowledge, attitudes and skills required by the technicians /technologists in the country. In this context the laboratory courses form a vital portion in the entire curriculum of technician education. The laboratory courses shall therefore be so designed and delivered that they help the students acquire attitudes and motor skills that are essential to function effectively as technicians/technologists.

The planning, organization and implementation of lab courses need a detailed description of tasks to be performed by the students. Well thought out instructional objectives to a large extent give these descriptions. The analysis of tasks (by identifying the activities the students are expected to do) help prepare the objectives meticulously. In other words the objectives would be clearer, when the task analysis is done to spell out the sub tasks for each objective.

A survey of the practices currently followed in the technical/technician education shows an urgent need to plug in gaps in instructional procedures. The reasons for these gaps are ambiguity in the minds of the teachers regarding tasks to be performed, levels of competency to be achieved by the students and the weightage to be allocated for each task. This aids in scientific design of instructional plan (optimizing the resources, budgeting the time & content).

The task analysis, teaching points and the structured scheme of evaluation are very important in focusing the instruction on specific skill of desired outcome and in evaluating the same. The Instruction and evaluation in Laboratory courses are different from that of cognitive lessons in the sense that adequate importance and hence weightage needs to be given for all three domains of learning viz. cognitive, psychomotor and affective. Since both training and evaluation of traits of affective domain are practically difficult, a few traits (called values) most relevant and essential to occupations/professions after the Course may be identified for the purpose. It is imperative to integrate these values during instruction and evaluation and also overtly notify the same to the students.

A technician, in addition to performing a skill needs to prepare a report of testing that includes the description of procedure, details of measurements made, reasoning based inferences and so on.,. The current practice of record writing has failed to achieve this purpose as most of the time students end up with making copies of available material.

Therefore, for sensitizing the need for the changes in laboratory instruction, the present hand book has been prepared to meet the above requirements. As such the hand book comprises four parts that intend to :

- Present task analysis, teaching points which can be used for effective design of instruction
- provide a scheme of evaluation with rationally allocated weightage to each significant skill component
- offer a set of questions designed at different levels of competencies for assessment enabling the teacher to set the question paper with balanced levels of competencies
- presentpre set worksheets that cultivate the habit of systematic recording of observations and writing the technical report.

- Provide all important data related to particular laboratory activity at one point in the form of annexure

1.1. STRUCTURE OF THE BOOK

The hand book is presented in four parts viz., Laboratory sheets, Worksheet, Experimental Methodology and Annexure. The description of each part is given in the following sections

Part I. Laboratory Sheet

The information provided in this part is useful for the teacher for designing the instruction, planning & organization of the experiment and for scientific evaluation of the students. The major features of the Laboratory sheet are further explained below.

1. **Objective**

   It indicates the **Task** to be performed and completed by the student during the specified duration of time.

2. **Task Analysis**

It is the process of identifying the component activities (sub tasks) to be carried out by the student in order to achieve the stipulated objective. As the task analysis aim at fitting the instructional objectives into various classes of behaviour, it would help the teacher to determine any particular type of behaviour the student has learnt / failed to perform.

The task analysis would help the teacher in identifying the specific activities to be performed by the students. This could also be used as some kind of check list to compare with activities planned for the laboratory. Further it would give clue to the teacher to make students think originally & act independently. It includes both psychomotor learning and the related cognitive information and hence the task analysis is presented as Knowledge and skill parts.

A. Knowledge Part: That includes the cognitive aspects of the task.

B. Skill Part: That includes Psychomotor & Affective aspects of the task.

3. **Teaching Points:**

This includes the points based on the SKILL identified with suggested duration for each point and total duration which helps the teacher for the time and content budgeting during instruction.

4. **Need and Scope:**

The purpose, application and scope of the task to be performed are normally included in this sub section.

5. **Planning and Organisation:**

It lists actions to be taken to perform various activities and hence useful in planning the instruction and organizing the resources and equipment

6. Scheme of Valuation:

The information provided in this section helps the teacher to devise a tool for rational measurement assessment of the competencies accomplished by the student.

Part II. Work Sheet

It is designed for the student, where in the student enters his personal data of identification, details of the experiment, stepwise procedure, observations made during experiment, a sample calculation, free hand typical graph, graph from experimental data and inference with discussion.

Part III. Experimental Methodology

This section furnishes information with regard to standard procedure to conduct the experiment along with the description of equipment/apparatus and the basic theory/concept involved in the conduct of the experiment. Thus this section is very useful for both teacher and student as well to conduct the experiment systematically. Thus this section is presented in four sub section as described below:

- **Description**

  It gives the detailed description of apparatus / tools / equipment / materials to be used for the task.

- **Theory / Concept**

  It gives the concept of the task to be performed with formulae and units.

- **Procedure**

  It provides the idea of step wise procedure to perform the task.

- **Observation and Calculation**

  It includes sample observation, sample graph, sample calculation for reference

Part IV. Annexure

All important and useful information that may help in accomplishment of tasks like conversion tables for units, technical & scientific data like material properities, standard trend or characteristic curves (graphs) etc are compiled and presented at one place in this section.

1.2. WHO IS TO USE AND HOW TO USE.

The hand book is so designed that it can be beneficially used by different sections of the technical education viz., the teacher, the student, the examiner and the administrator convenient to individual's requirements. A few uses of this hand book each stakeholder could make is outlined in the following sections.

1. Teacher

A. The **laboratory sheet** is designed keeping the teacher in mind for the teacher has key responsibility of imparting the skills to the student and hence the information given in the lab sheets may be useful for planning & organizing the experimental set up and designing an effective instruction.Thus the teacher may

Plan and organize as per *section 4*,

Instruct the students as per*section 2***,**

Demonstrate each sub task as per *section1.B*.and

Evaluate the students as per *section 5***,** according to the level of competency.

Values: The values in a personare an important personality trait that needs to be nurtured in the learning environment. Further it is also a driving component in any individual to deliver the best and hence this component is also included in the evaluation. However only five key dimensions, that are important in the teaching-learning environment, are taken into consideration for nurturing and evaluation. A little information about these five dimensions is given below as a guideline for the teacher while assessing students.

1. Co-operation: It is thevoluntary arrangement in which two or more students engage in a mutually beneficial exchange, instead of competition. Cooperation can happen where resources adequate for both students exist or are created by their interaction.

2. Co-ordination: It is the unification, integration, synchronization of the effect of group members so as provide unity of action in the pursuit of common goals. It is an integral element and required in each & every function and at each & every stage & therefore it cannot be separated.

3. Communication; Communication skill is the set of skills that enables a student to convey information so that it is received and understood.

4. Sharing: A part or portion belonging to, distributed to, contributed by, owed by a person or a group **Or** To participate in, use, enjoy or experience jointly or in turns.

5. Leadership: Students with the following leadership qualities are almost always the ones that rise above the crowd.

1. Trustworthiness: This refers to integrity.

2. Inspiration: Guides, leads and inspiring others to want to participate in the process of moving towards the vision.

3. Self awareness: It is the individual awareness of him or her self – their abilities and the impact that they have on others.

4. Acceptance of responsibility: True leaders are accepting responsibility for all that comes their way and taking ownership and responsibilities for getting things back on track. Blaming, justifying and excuse making just is not in their responsibility.

B. The**Experimental methodology** is designed for both teacher and student. The teacher can refer the experimental methodology for the details of equipment/apparatus/ materials/tools, procedure to be followed, observations to be made, graphs to be drawn and calculations to be done for the task to be performed

2. Student

The Worksheet is designed keeping in view the needs, deficiencies and the adolescent characteristics of the student for student.

The students submit the filled in work sheet given by the teacher on the day of experiment after referring to experimental methodology and listening to instructions of teacher. The design of the worksheet is made user friendly and the contents are so logically sequenced that the student finds it easy to understand and develop the skill of recording and report writing skill. It also helps the student to actively participate in skill learning. More importantly the student gets immediate meaningful feedback of his performance since the competency wise assessment is done and that too on the same day.

3. Examiner

The examiner may find this hand book very useful as Laboratory sheets and Scheme of evaluation provides information with regard to various competencies (skills) the students is expected to acquire during the course of study and the relative weightages of each competency. This information helps him to design a well balance question paper/measurement tool for assessment.

HALFWAVE RECTIFIER WITH AND WITHOUT FILTER

OBJECTIVE:

1.To measure the dc voltage, ripple voltage and determine ripple factor and percentage of regulation of half wave rectifier with and without filter
2. To obtain the output waveforms of Half Wave Rectifier with and without Filter

APPARATUS:

S.No.	Name of the component	Specifications/ Range	Quantity
1	Step-down transformer	230/0-9 V,500mA	1
2	Diode	IN4007/IN4002/IN4001	1
3	Decade resistance box	10ohm -1 M ohms	1
4	DC ammeter	0-50 mA	1
5	DC Voltmeter	0-25V	1
6	AC voltmeter/ Multimeter	0-1 V	1
7	C.R.O	Dual Trace 0-20 M Hz	1
8	Breadboard	1	
9	Connecting Wires	Hook-up wire	As per need
10	Capacitor	1000µF/25V	1

TASK ANALYSIS:

A. KNOWLEDGE

1. Main purpose of rectifier
2. Working principle of PN diode in forward bias and reverse bias
3. Ripple factor formula and its theoretical value
4. percentage of regulation formula
5. Need for filter
6. Applications of rectifier.
7. Output waveforms
8. Precautions

B. SKILL

Handling of Apparatus	• Identifying the various components • Selecting the correct range of voltmeters and ammeters • setting the CRO • Testing of transformer working condition • Setting the resistance value in DRB at maximum position
Manipulation of apparatus	• Drawing the circuit diagram • Making the connections as per circuit. • Connect the meters with correct polarities. • Checking the connections • Switch on the supply.
Precise operations/Activities	• Measuring the no-load voltage by removing DRB • Adjusting the load resistance value in DRB. • Recording the values of Idc,Vac,Vdc • Calculating the ripple factor • Calculating the percentage of regulation • Observing the output waveforms on CRO • Drawing the graph • Connecting the Capacitor filter • Measuring the no-load voltage by removing DRB • Adjusting the load resistance value in DRB. • Recording the values of I_{dc},V_{ac},V_{dc} • Calculating the ripple factor • Calculating the percentage of regulation • Observing the output waveforms on CRO • Drawing the graph

2. TEACHING POINTS

SlNo	TeachingPoint	SuggestedTime-15min
1.	Purposeofrectifier	2
2.	Typesofrectifiers	1
3.	WorkingprincipleofPNdiodeinForwardbiasandReversebias	2
4.	Ripplefactorformulaanditstheoreticalvalue	1
5.	Percentageofregulationformula	1
6.	UsageofCRO	1
7.	InputandOutputwaveforms	2
8.	Needforfilter	1
9.	Applicationsof Half waverectifier	2
10.	Precautions	2

5. SCHEME OF EVALUATION

<table>
<tr><th>CATEGORY OF SKILL</th><th>SUB TASK</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Identifying the various Components & selecting the correct range voltmeters and ammeter
B. Setting the CRO
C.Testing of transformer working condition</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>3</td><td>1</td><td>1</td><td>5</td></tr></table></td></tr>
<tr><td>2. Manipulation of apparatus</td><td>A. Drawing the circuit diagram
B. Making the connections as per circuit.
C. Connect the meters with correct polarities</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>5</td><td>8</td><td>2</td><td>15</td></tr></table></td></tr>
<tr><td>3.Precise operations/ Activities</td><td>A. Measuring the no load voltage.
B. Taking the readings of Ammeter and Voltmeters
C. Calculating Ripple factor and percentage of regulation
D. Observing the waveforms
E. Drawing the Graph</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>2</td><td>6</td><td>6</td><td>5</td><td>6</td><td>25</td></tr></table></td></tr>
<tr><td>4.Values</td><td>A. Co Operation
B. Co-Ordination
C. Communication
D. Sharing
E. Leadership</td><td><table><tr><td></td></tr><tr><td>5</td></tr></table></td></tr>
<tr><td colspan="2">Total</td><td>50</td></tr>
</table>

6. ASSESSMENT / VIVA QUESTIONS :

1. What is rectifier?
2. List the types of rectifier.
3. What is the value of ripple facto.r
4. How to calculate percentage of regulation.
5. What is the need for Filter in the rectifier.
6. Is it possible to reduce the ripple.
7. List the applications of Half wave rectifier.

CENTER TAPPED FULLWAVE RECTIFIER

OBJECTIVE:1. To measure the dc voltage, ripple voltage and determine ripple factor and percentage of regulation of half wave rectifier with and without filter
2. To obtain the output waveforms of Half Wave Rectifier with and without
Filter

APPARATUS REQUIRED:

Name	Specifications/ Range	No
Step-downtransformer	230/0-9V,500mA	1
Diode	IN4007/IN4002/ IN4001	2
Decaderesistancebox	10ohm-1Mohms	1
DCammeter	0-50 mA	1
DCVoltmeter	0-25V	1
AC voltmeter/Multimeter	0-1 V	1
C.R.O	DualTrace 0-20MHz	1

1.TASKANALYSIS:

A.KNOWLEDGE

1. Transformerworkingprinciple
2. Working principleof PN-Junctiondiode
3. Typesof diodes
4. Typesof capacitorsanditsuse
5. Applicationsof PNJunction DiodeandCapacitor
6. TheoreticalvalueofRipplefactorandMaximumefficiencyofFWR.
7. Needforfiltersinpowersupplies
8. Precautions.

B. SKILL

Handling of Apparatus	• Identifying various terminals • Using correct range of Voltmeters and Ammeters. • Setting the DRB to correct values. • Identification of Transformer terminals by markings. • Identification of capacitor and inductor values for filter circuits. • Selecting the correct wires and meters.
Manipulation of apparatus	• Drawing the Circuit Diagram. • Making the connections as per the circuit diagram. • Adjusting the load resistance in DRB • Switching on the supply. • Connect capacitor filter as per circuit • Drawing the graph between Ripple Factor vs I_L or R_L and % regulation vs I_L or R_L .
Precise operations/Activities	**Without Filter** • Measure Vdc (no Load) • Increase the load resistance in steps of 1kΩ. • Recording the values of Idc, Vdc, Vac on multimeter. • observing the readings in the multimeter • Observing the waveforms with and without filter on CRO. • Calculating the values of Ripple factor, efficiency and % of regulation. **With Filter** • Measure Vdc (no Load) • Connect 1kΩ load resistor. • Measure I_{dc}, V_{dc} and V_{ac} • Tabulate the readings and observe the waveforms on CRO.

2. TEACHING POINTS:

Sl No	Teaching Point	Suggested Time-15 min
1.	Working of Transformer.	2
2.	Operation of CRO.	1
3.	Working principle of a PN-Junction diode.	2
4.	Working of capacitors and its types.	2
5.	Types of Filters.	1
6.	Need for filters.	1
7.	Procedure for calculating Ripple Factor & Efficiency.	2
8.	Procedure for calculating % regulation.	1
9.	Interpreting Name plate Details.	2
10.	Precautions.	1

PRECAUTIONS:

A. PROCEDURAL PRECAUTIONS:

- Disconnect all the equipment from mains before making connections
- Ensure the correct range of meters
- Connect the circuit as per the circuit diagram and check for polarity
- Get the connections checked by the concerned staff member
- Calibrate the CRO for getting accurate result.
- Use the proper Transformer.
- Ensure that there are no loose connections
- Filter capacitor should be connecting with proper polarity.

B. SAFETY PRECAUTIONS:

- Never work on a circuit while power is applied.
- Do not connect power to a circuit until the circuit is finished and you have carefully checked your work.
- If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry.
- Always wear safety goggles.

3. NEED AND SCOPE OF EXPERIMENT

This experiment is essential to understand the performance of Full wave Rectifier Circuit under various load resistance values. Due to its higher rectification efficiency, low power loss and Low ripples it is adopted in the industry for various applications This test also gives an insight in to Standard testing procedures adopted in the industry and suitability of DC shunt motor for various applications.

4. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	• The Meters, Diodes and CRO. • Transformers. • The students entry behavior • First aid kit • Wires of Standard colours and Gauges
For Design of Instruction	• Read teaching points carefully.

5. SCHEME OF EVALUATION:

<table>
<tr><th>CATEGORY OF SKILL</th><th>SUB TASK</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th></tr>
<tr><td>1. Handling of apparatus</td><td>A. Identification of Correct Components
B. Identification of meters
C. Identification of Transformer Terminals by marking .</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>2</td><td>2</td><td>1</td><td>5</td></tr></table></td></tr>
<tr><td>2. Manipulation of apparatus</td><td>A. Making Circuit connections
B. Adjusting the load resistance in the DRB
C. Increasing the value of load resistance in steps of 1KΩ</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>4</td><td>5</td><td>6</td><td>15</td></tr></table></td></tr>
<tr><td>3.Precise operations/Activities</td><td>A. Recording the readings in the Ammeters, Voltmeter (or) Multimeter.
B. Measuring the values of Idc, Vdc and Vac(with load and without Load).
C. Calculate the Ripple factor and % of regulation.
D. Observe the waveforms across the load resistance on CRO.
E. Drawing the graph and to showing salient points</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr></table></td></tr>
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<tr><td colspan="2">Total</td><td>50</td></tr>
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6. ASSESSMENT / VIVA QUESTIONS:

1. What is a Diode?
2. What is filter?
3. What is the efficiency of FWR with center tapped?
4. What is the value of PIV of a center tapped FWR.
5. In filter capacitor is always connected in parallel, why?
6. What is the purpose of center tapped transformer.
7. What is regulation?
8. Define ripple factor and its values for all three types of the rectifiers.
9. What is the value of No load voltage for all three types of rectifiers?
10. What are the different types of filters used for the rectifiers?

BRIDGE RECTIFIER

OBJECTIVE:

1. To measure the dc voltage, ripple voltage and determine ripple factor andpercentage of regulation of Bridge rectifier with and without filter
2. To obtain the output waveforms of Bridge Rectifier with and without Filter

APPARATUS REQUIRED:

Name	Specifications/ Range	No
Step-downtransformer	230/0-9V,500mA	1
Diode	IN4007/IN4002/IN4001	4
Decaderesistancebox	10ohm-1Mohms	1
DCammeter	0-50 mA	1
DCVoltmeter	0-25V	1
ACvoltmeter/Multimeter	0-1 V	1
C.R.O	DualTrace 0-20 MHz	1

1.TASK ANALYSIS:

A. KNOWLEDGE

1. Transformerworkingprinciple
2. Working principleof PN-Junctiondiode
3. Typesof diodes
4. Typesof capacitorsanditsuse

B. SKILL

HandlingofApparatus	• Identifyingvariousterminals • UsingcorrectrangeVoltmeter,Ammeters. • SettingtheDRBtocorrectvalues. • IdentificationofTransformerterminalsbymarkings. • Identificationofcapacitorandothercomponents.
Manipulation ofapparatus	• Drawthe Circuit Diagram. • Makingtheconnectionsasperthecircuitdiagram. • AdjustingtheloadresistanceinDRB
Preciseoperations/Activities	**Without Filter** • MeasureVdc(noLoad) • Increasetheloadresistanceinstepsof1kΩ. • RecordingthevaluesofVdc,Vaconmultimeter. • Observingthereadingsinthemultimeter • ObservingthewaveformsonCRO. • Calculating the values of Ripple factor and % of regulation asperttheformulas. **With Filter** • MeasureVdc(noLoad) • Connect1000µf,25Vcapacitorasshownincircuit. • Measure V_{dc} and V_{ac} • Tabulatethereadingsandobservethewaveformson CRO.

2. TEACHING POINTS:

Sl No	Teaching Point	Suggested Time-15 min
1.	Working of Transformer.	2
2.	Operation of CRO.	1
3.	Working principle of a PN-Junction diode.	2
4.	Working of capacitors and its types.	2
5.	Types of Filters.	1
6.	Need for filters.	1
7.	Procedure for calculating Ripple Factor.	2
8.	Procedure for calculating % regulation.	1
9.	Interpreting Name plate Details.	2
10.	Precautions.	1

PRECAUTIONS

A. PROCEDURAL PRECAUTIONS:

Disconnect all the equipment from mains before making connections

- Ensure the correct range of meters
- Connect the circuit as per the circuit diagram and check for polarity
- Get the connections checked by the concerned staff member
- Calibrate the CRO for getting accurate result.
- Use the proper Transformer.
- Ensure that there are no loose connections
- Filter capacitor should be connecting with proper polarity.

B. SAFETY PRECAUTIONS:

- Never work on a circuit while power is applied.
- Do not connect power to a circuit until the circuit is finished and you have carefully checked your work.
- If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry.
- Always wear safety goggles.

3. NEED AND SCOPE OF EXPERIMENT

This experiment is essential to understand the performance of Bridge Rectifier Circuit under various load resistance values. Due to its higher rectification efficiency, low power loss and Low ripples it is adopted in the industry for various applications This test also gives an insight in to Standard testing procedures adopted in the industry and suitability of DC shunt motor for various applications.

4. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	• The Meters, Diodes and CRO. • Transformers. • The students entry behavior • First aid kit • Wires of Standard colours and Gauges
For Design of Instruction	• Read teaching points carefully.

5. SCHEME OF EVALUATION:

<table>
<tr><th>CATEGORY OF SKILL</th><th>SUB TASK</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th></tr>
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B) Using correct range Voltmeter, Ammeters.
C) Setting the DRB to correct values.
D) Identification of Transformer terminals by markings.
E) Identification of capacitor and inductor values for filter circuits.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table></td></tr>
<tr><td>2. Manipulation of apparatus</td><td>A) Draw the Circuit Diagram.
B) Making the connections as per the circuit diagram.
C) Adjusting the load resistance in DRB
D) Connect capacitor filter .
in the figure.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>5</td><td>5</td><td>3</td><td>2</td><td>15</td></tr></table></td></tr>
<tr><td>3.Precise operations/Activities</td><td><u>Without Filter</u>
A) Measure Vdc (no Load)
B) Increase the load resistance in steps of 1kΩ.
C) Recording the values of Vdc, Vac onmultimeter.
D) Observing the waveforms on CRO.
E) Calculating the values of Ripple factor and % of regulation.

<u>With Filter</u>
F) Connect 1000µf capacitor as shown in circuit.
G)Measure V_{dc} and V_{ac} .
Tabulate the readings and observe the waveforms on CRO
H) Drawing the graphs</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>T</td></tr><tr><td>2</td><td>2</td><td>4</td><td>3</td><td>3</td><td>2</td><td>4</td><td>5</td><td>25</td></tr></table></td></tr>
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6. ASSESSMENT / VIVA QUESTIONS:

1. What is a rectifier?
2. When the Diode become forward bias?
3. What is the efficiency of bridge rectifier?
4. What is the value of PIV of a bridge rectifier?.
5. What is need of filter?
6. What is regulation?
7. Define ripple factor and its values for all three types of the rectifiers.
8. What are the different types of filters used for the rectifiers?

2.4. ZENER DIODE AS REGULATOR LAB SHEET

ZENER DIODE AS A REGULATOR

1. OBJECTIVE: To obtain the Voltage Regulation characteristics of Zener regulator.

2.APPARATUS:

Name	Specifications/ Range	No	Purpose
Ammeter (MC)	(0-250)mA	1	To observe Load current I_L
Voltmeter(MC)	(0-30)V	1	To observe voltage across Zener Diode terminals
Resistance	1k, 2k, 3k	1	To get the load output voltages
ZENER DIODE	6.2 V Breakdown Voltage	1	To get the regulated output voltage
Connecting Wires	Red , Green, Blue , Yellow and Black 3/20 gauge , suitable lengths	As per the need	To make connections and interconnections to equipment

3. TASK ANALYSIS

A. KNOWLEDGE

1. PN Junction Diode:
2. Zener Diode Biasing types
3. a) Forward Bias b) Reverse Bias
4. Need of Regulators
5. Need of RPS in Electronic circuits
6. Breakdown concepts
7. a. Avalanche Breakdown b. Zener Breakdown
8. Factors affecting the REGULATION
9. Applications of Zener Diode
10. Precautions.

B. SKILL

Handling of Apparatus	• Drawing the circuit diagram • Identifying various terminals of ZENER DIODE • Using correct range Voltmeter, Ammeters. • Varying the RPS • Bread board knowledge. • Varying of the load resistance
Manipulation of apparatus	• Reading the Circuit Diagram. • Making the connections. • Checking the connections • Switch on the supply. • Observing the readings in the Ammeter and Voltmeter.
Precise operations/Activities	• Adjusting the RPS to minimum position and maximum position as to get the required voltage. • Recording and observing the readings on voltmeter, Ammeter. • Finding Breakdown voltage or output voltage. • Calculating the REGULATION of the Zener Diode. • Drawing the graphs.

4. TEACHING POINTS:

Sl No	Teaching Points	Suggested Time-15 min
1	Types of Breakdown Mechanisms.	2
2	Purpose of Regulation	2
3	Need of Regulators	2
4	Need of RPS in Electronic circuits	2
5	Zener Breakdown mechanism	3
6	Factors affecting the REGULATION	1
7	Applications of Zener Diode	2
8	Precautions	1

5. A. Procedural precautions:

1. Disconnect all the equipment from mains before making connections
2. Ensure the correct range of meters
3. Ensure that the meters and RPS and Zener Diode are connected properly.
4. Connect the circuit as per the circuit diagram and check for polarity of ZENER DIODE.
5. Get the connections checked by the concerned staff member.
6. Ensure that there are no loose connections.

B. Safety precautions:

1. The terminals of the zener diode should be properly identified.
2. .While determined the load regulation; load should not be immediately shorted.
3. Should be ensured that the applied voltages & currents do not exceed the ratings of the diode.

4. NEED AND SCOPE OF EXPERIMENT:

a) Used as Voltage Regulator

b) Used in regulated power supplies to get the constant output voltages

Irrespective input voltage and load variations.

6. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	• Checking for all circuits • The students entry behavior • First aid kit • Getting of all components with good rating.
For Design of Instruction	• Read teaching points carefully.

7. SCHEME OF EVALUATION

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL (50)
1. Handling of apparatus	A. Drawing circuit diagram and Identifying various terminals of ZENER Diode. B. Using correct range Voltmeter, Ammeter C. Connecting the ZENER DIODE in the circuit with correct polarity.	A: 2, B: 1, C: 2, T: 5	5
2. Manipulation of apparatus	A. Varying the value of RPS B. Observing the readings in the Ammeter and Voltmeter	A: 7, B: 8, T: 15	15

3.Precise operations/Activities	A. Recording and observing the readings on voltmeter, Ammeter. B. Finding Breakdown voltage or output voltage. C. Calculating the REGULATION of the Zener Diode. D. Drawing the graphs.	<table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>5</td><td>8</td><td>7</td><td>5</td><td>25</td></tr></table>	25
4.Values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	<table><tr><td></td></tr><tr><td>5</td></tr></table>	5
Total		50	

8. ASSESSMENT / VIVA QUESTIONS :

VIVA QUESTIONS:-

1. What type of temp Coefficient does the Zener diode have?
2. If the impurity concentration is increased, how the depletion width effected?
3. Does the dynamic impendence of a Zener diode vary?
4. Explain briefly about avalanche and Zener breakdowns?
5. Draw the Zener equivalent circuit?
6. Differentiate between line regulation & load regulation?
7. In which region Zener diode can be used as a regulator?
8. How the breakdown voltage of a particular diode can be controlled?
9. What type of temperature coefficient does the Avalanche breakdown has?
10. By what type of charge carriers the current flows in Zener and avalanche breakdown diodes?

IC REGULATOR

Objective:

To obtain the regulation characteristics IC regulator (78XX).

Apparatus required:

IC 7805 1no

1. RPS(0-30v) 1 no
2. Digital Multimeter 1no
3. Capacitor 10 µ f& 1 µ f 1 no each
4. Bread board 1no
5. Connecting wires

1. Task analysis:

A. Knowledge

1. Voltage regulator principle
2. Pin configuration of IC 7805
3. Types of capacitors and its use
4. Working of RPS
5. Working of digital multimeter
6. Precautions

B. Skills

S.No	Category of skill	Subtask
1	Handling apparatus	a) Identification of Components and its terminals b) Using correct range meters. c) Setting the RPS to minimum volts position d) Identification of capacitor values e) Selecting proper wires and meters
2	Manipulations of apparatus	a) Draw the circuit diagram b) Make the connections as per the Circuit. c) Adjust the appropriate voltage level in Dual regulated power supply d) Adjust the RPS for different set of readings e) Draw regulation characteristics
3	Precise operations/activities	a) Measure the output voltage corresponding to input voltage. b) Record the values of output and input voltages c) Identify the point of saturation of output voltage
4	Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

2. TEACHING POINTS:

S.No	Teaching point	Time allocation
1.	Voltage regulator principle	**2min**
2.	Details Pin configuration of IC 7805	**3min**
3.	Types of capacitors and its use	**2min**
4.	Operation of RPS	**3min**
5.	Operation of digital multimeter	**2min**
6	Regulation characteristics	**2min**
7	Precautions	**1min**

3.PROCEDURE:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B . Safety precautions

- Never make connections on a circuit when supply is in ON position
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry
- Always wear safety goggles

4. NEED & SCOPE:

7805 voltage regulators are very commonly used in electronic circuits. The main purpose of this IC is to supply required regulated positive voltage to the circuits. IC 7805 can supply a constant positive voltage output, in spite of any voltage fluctuations in its input voltage. It can be mainly found in the circuits in which integrated circuits that require +Vcc and – Vcc are used.

5. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	• The Meters, Diodes and CRO. • Transformers. • The students entry behavior • First aid kit • Wires of Standard colours and Gauges
For Design of Instruction	• Read teachingpointscarefully.

6. SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUBTASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Handling apparatus	a. Identification of Components and its terminals. b. Setting the RPS to minimum volts position c. Identification of capacitor values d. Selecting proper wires and meters	A B C D T 2 1 1 1 5
Manipulations of apparatus	a) Drawing the circuit diagram b) Selecting correct range meters c) Making the connections as per the Circuit. d) Adjusting the appropriate voltage level in Dual regulated power supply e) Adjusting the RPS for different set of readings f) Drawing regulation characteristics	A B C D E F T 6 2 2 2 2 1 15
Precise operations/activities	a) Measuring the output voltage corresponding to input voltage. b) Recording the values of output and input voltages c) Identifying the point of saturation of output voltage	A B C T 10 10 5 25
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	A B C D E T 1 1 1 1 1 5
TOTAL		**50**

7. ASSESSMENT / VIVA QUESTIONS:

- What does 78xx series tells us?
- How many pins does 7805 IC have ?
- what is a voltage regulator IC?
- What does xx in 78xx indicate ?
- Which is the input terminal of IC 7805?
- Which is the output terminal of IC 7805?
- What is the output voltage of IC7805?
- Why 7805is used in a circuit
- What are the other voltage regulator IC s ?
- What is the minimum input voltage to the IC 7805 ?

IC REGULATOR

OBJECTIVE :

To obtain the regulation characteristics of IC regulator (79XX).

Apparatus required :

1. IC 7912 1no
2. RPS(0-30v) 1 no
3. Digital Multimeter 1no
4. Capacitor 10 µ f& 1 µ f 1 no each
5. Bread board 1no
6. Connecting wires

1. TASK ANALYSIS:

A. KNOWLEDGE

1. Voltage regulator principle
2. Pin configuration of IC 7912
3. Types of capacitors and its use
4. Working of RPS
5. Working of digital multi meter
6. Precautions

B. SKILLS

S.NO	CATEGORY OF SKILL	SUBTASK
1	Handling apparatus	a) Identification of Components and its terminals b) Using correct range meters. c) Setting the RPS to minimum volts position d) Identification of capacitor values e) Selecting proper wires and meters
2	Manipulations of apparatus	a) Draw the circuit diagram b) Make the connections as per the Circuit. c) Adjust the appropriate voltage level in Dual regulated power supply d) Adjust the RPS for different set of readings e) Draw regulation characteristics
3	Precise operations/activities	a) Measure the output voltage corresponding to input voltage. b) Record the values of output and input voltages c) Identify the point of saturation of output voltage
4	Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

2. TEACHING POINTS:

S.No	Teaching point	Time allocation
1.	Voltage regulator principle	**2min**
2.	Details Pin configuration of IC 7912	**3min**
3.	Types of capacitors and its use	**2min**
4.	Operation of RPS	**3min**
5.	Operation of digital multimeter	**2min**
6	Regulation characteristics	**2min**
7	Precautions	**1min**

3. PROCEDURE

A. PROCEDURAL PRECAUTIONS

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B .SAFETY PRECAUTIONS

- Never make connections on a circuit when supply is in ON position
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry
- Always wear safety goggles

4. NEED & SCOPE:

7912 voltage regulators are very commonly used in electronic circuits. The main purpose of this IC is to supply required regulated negative voltage to the circuits. IC 7912 can supply a constant negative voltage output, in spite of any voltage fluctuations in its input voltage. It can be mainly found in the circuits in which integrated circuits that require +Vcc and – Vcc are used.

5. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	• The Meters, Diodes and CRO. • Transformers. • The students entry behavior • First aid kit • Wires of Standard colours and Gauges
For Design of Instruction	• Read teachingpointscarefully.

6.SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUBTASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
Handling apparatus	a. Identification of Components and its terminals. b. Setting the RPS to minimum volts position c. Identification of capacitor values d. Selecting proper wires and meters	A B C D T 2 1 1 1 5	5
Manipulations of apparatus	a) Drawing the circuit diagram b) Selecting correct range meters c) Making the connections as per the Circuit. d) Adjusting the appropriate voltage level in Dual regulated power supply e) Adjusting the RPS for different set of readings f) Drawing regulation characteristics	A B C D E F T 6 2 2 2 2 1 15	15
Precise operations/activities	a) Measuring the output voltage corresponding to input voltage. b) Recording the values of output and input voltages c) Identifying the point of saturation of output voltage	A B C T 10 10 5 25	25
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	A B C D E T 1 1 1 1 1 5	5
TOTAL			**50**

7. ASSESSMENT / VIVA QUESTIONS:

- What does79xx series tells us?
- How many pins does 7912 IC have?
- What is a voltage regulator IC?
- What does xx in 79xx indicate?
- Which is the input terminal of IC 7912?
- Which is the output terminal of IC 7912?
- What is the output voltage of IC 7912?
- Why 7912 is used in a circuit
- What are the other voltage regulator IC s ?
- What is the minimum input voltage to the IC 7912 ?

IC REGULATOR

OBJECTIVE:

To obtain the regulation characteristics of IC regulator(LM 317).

APPARATUS REQUIRED :

1. LM317 1no
2. RPS(0-30v) 1 no
3. Digital Multimeter 1no
4. Capacitor 1 µ f&0.1 µ f 1 no each
5. Bread board 1no
6. Connecting wires

1. TASK ANALYSIS:

A. KNOWLEDGE

1. Voltage regulator principle
2. Pin configuration of IC 7805
3. Types of capacitors and its use
4. Working of RPS
5. Working of digital multimeter
6. Precautions

B. SKILLS

S.No	Category of skill	Subtask
1	Handling apparatus	f) Identification of Components and its terminals g) Using correct range meters. h) Setting the RPS to minimum volts position i) Identification of capacitor values j) Selecting proper wires and meters
2	Manipulations of apparatus	f) Draw the circuit diagram g) Make the connections as per the Circuit. h) Adjust the appropriate voltage level in Dual regulated power supply i) Adjust the RPS for different set of readings j) Draw regulation characteristics
3	Precise operations/activities	d) Measure the output voltage corresponding to input voltage. e) Record the values of output and input voltages f) Identify the point of saturation of output voltage
4	Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

2. TEACHING POINTS:

S.No	Teaching point	Time allocation
1.	Voltage regulator principle	**2min**
2.	Details Pin configuration of LM317	**3min**
3.	Types of capacitors and its use	**2min**
4.	Operation of RPS	**3min**
5.	Operation of digital multimeter	**2min**
6	Regulation characteristics	**2min**
7	Precautions	**1min**

3.PROCEDURE:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B . Safety precautions

- Never make connections on a circuit when supply is in ON position
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry
- Always wear safety goggles

4.NEED& SCOPE:

The LM317 device is an adjustable three-terminal positive-voltage regulator capable of supplying more than 1.5 A over an output-voltage range of 1.25 V to 37 V. It requires only two external resistors to set the output voltage. The device features a **typical line regulation of 0.0**typical load regulation of 0.1%

5. PLANNING AND ORGANISATION:

ACTION	ACTIVITY
Check for	• The Meters, Diodes and CRO. • Transformers. • The students entry behavior • First aid kit • Wires of Standard colours and Gauges
For Design of Instruction	• Read teachingpointscarefully.

6. SCHEME OF EVALUATION:

<table>
<tr><th>Category of skill</th><th>Subtask</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th><th>TOTAL</th></tr>
<tr><td>Handling apparatus</td><td>a. Identification of Components and its terminals.
b. Setting the RPS to minimum volts position
c. Identification of capacitor values
d. Selecting proper wires and meters</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>2</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table></td><td>5</td></tr>
<tr><td>Manipulations of apparatus</td><td>a) Drawing the circuit diagram
b) Selecting correct range meters
c) Making the connections as per the Circuit.
d) Adjusting the appropriate voltage level in Dual regulated power supply
e) Adjusting the RPS for different set of readings
f) Drawing regulation characteristics</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>T</td></tr><tr><td>6</td><td>2</td><td>2</td><td>2</td><td>2</td><td>1</td><td>15</td></tr></table></td><td>15</td></tr>
<tr><td>Precise operations/activities</td><td>a) Measuring the output voltage corresponding to input voltage.
b) Recording the values of output and input voltages
c) Identifying the point of saturation of output voltage</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>10</td><td>10</td><td>5</td><td>25</td></tr></table></td><td>25</td></tr>
<tr><td>Values</td><td>• Co-operation
• Co-ordination
• Communication
• Sharing
• Leadership</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table></td><td>5</td></tr>
<tr><td colspan="3">TOTAL</td><td>50</td></tr>
</table>

7. ASSESSMENT / VIVA QUESTIONS :

- WhatdoesLM317 series tells us?
- How many pins does LM317 IC have ?
- What is a voltage regulator IC?
- What does xx in LM317 indicate?
- Which is the input terminal of IC LM317?
- Which is the output terminal of ICLM317?
- What is the output voltage of IC LM317?
- Why LM317is used in a circuit
- What are the other voltage regulator IC s ?
- What is the minimum input voltage to the ICLM317?

REGULATED POWER SUPPLY USING 78XX/79XX

OBJECTIVE :

a) To construct regulated power supply using 78XX/79XX

APPARATUS REQUIRED :

1. IC 7812 1No.
2. IC 7912 1No.
3. RPS(0-30v) 1 No.
4. Digital Millimeter 1No.
5. Capacitor 10 µf & 1 µf - 1 No. each
6. Bread board 1No.
7. Connecting wires

2. TASK ANALYSIS:

A. KNOWLEDGE

1. Voltage regulator principle
2. Pin configuration of IC 7812
3. Pin configuration of IC 7912
4. Types of capacitors and its use
5. Working of RPS
6. Working of digital millimeter
7. Precautions

B. SKILLS

S.No	Category of skill	Subtask
1	Handling apparatus	a) Identification of Components and its terminals b) Using correct range meters. c) Setting the RPS to minimum volts position d) Identification of capacitor values e) Selecting proper wires and meters
2	Manipulations of apparatus	a) Draw the circuit diagram b) Make the connections as per the Circuit. c) Adjust the appropriate voltage level in Dual regulated power supply d) Adjust the RPS for different set of readings e) Draw regulation characteristics
3	Precise operations/activities	a) Measure the output voltage corresponding to input voltage. b) Record the values of output and input voltages c) Identify the point of saturation of output voltage
4	Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

2. TEACHING POINTS:

S.No	Teaching point	Time allocation
1.	Voltage regulator principle	**2min**
2.	Details Pin configuration of IC 7812 & IC7912	**3min**
3.	Types of capacitors and its use	**2min**
4.	Operation of RPS	**3min**
5.	Operation of digital millimeter	**2min**
6	Regulation characteristics	**2min**
7	Precautions	**1min**

3. PROCEDURE:

A. PROCEDURAL PRECAUTIONS

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B .SAFETY PRECAUTIONS

- Never make connections on a circuit when supply is in ON position
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry.
- Always wear safety goggles

4.NEED&SCOPE :

7912 voltage regulators are very commonly used in electronic circuits. The main purpose of this IC is to supply required regulated negative voltage to the circuits. IC 7912 can supply a constant negative voltage output, in spite of any voltage fluctuations in its input voltage. It can be mainly found in the circuits in which integrated circuits that require +Vcc and – Vcc are used.

5. PLANNING AND ORGANIZATION :

ACTION	ACTIVITY
1. Check for	• Circuit components • Connecting Wires • Students entry behavior • First aid kit
For Design of Instruction	• Read teaching points carefully.

6. SCHEME OF EVALUATION:

<table>
<tr><th>Category of skill</th><th>Subtask</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th><th>TOTAL</th></tr>
<tr><td>Handling apparatus</td><td>a. Identification of Components and its terminals.
b. Setting the RPS to minimum volts position
c. Identification of capacitor values
d. Selecting proper wires and meters</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>2</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table></td><td></td></tr>
<tr><td>Manipulations of apparatus</td><td>a) Drawing the circuit diagram
b) Selecting correct range meters
c) Making the connections as per the Circuit.
d) Adjusting the appropriate voltage level in Dual regulated power supply
e) Adjusting the RPS for different set of readings
f) Drawing regulation characteristics</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>T</td></tr><tr><td>6</td><td>2</td><td>2</td><td>2</td><td>2</td><td>1</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>Precise operations/activities</td><td>a) Measuring the output voltage corresponding to input voltage.
b) Recording the values of output and input voltages
c) Identifying the point of saturation of output voltage</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>10</td><td>10</td><td>5</td><td>25</td></tr></table></td><td></td></tr>
<tr><td>Values</td><td>• Co-operation
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• Leadership</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table></td><td></td></tr>
</table>

7. ASSESSMENT / VIVA QUESTIONS:

1. What does 78xx series tells us?
2. What does79xx series tells us?
3. How many pins does 7912 IC have ?
4. How many pins does 7912 IC have ?
5. What is a voltage regulator IC?
6. What does xx in 78XX/79XX indicate ?
7. Which is the input terminal of IC 7912?
8. Which is the output terminal of IC 7912?
9. What is the output voltage of IC 7912?
10. Why 7912 is used in a circuit?
11. What are the other voltage regulator ICs ?
12. What is the minimum input voltage to the IC 7912?

SINGLE STAGE TRANSFORMER COUPLED CE AMPLIFIER

OBJECTIVE:

To plot the frequency response characteristics of a single stagetransformer coupled CE amplifier.

APPARATUS: Regulated Power Supply: 0-30V

CRO : 0-20MHz
Digital Multimeter
Signal Generator : 1Hz – 1MHz
Resistors : 4.3KΩ, 2.2KΩ, 1KΩ, 5.7KΩ
Capacitors : 10µF (2No.s)
Transistor : BC107
Driver Transformer
Bread board
Connecting wires

1. TASK ANALYSIS:

A. KNOWLEDGE

1. Amplifier principle
2. Transformer principle
3. Coupling methods
4. Gain formula
5. Frequency response
6. Use of CRO, Signal Generator and RPS
7. Drawing Logarithmic graph

B. SKILL

Handling of Apparatus	• Identifying the equipment . • Selecting correct components, meters and wires. • Identification of Transformer terminals by markings. • Identifying the transistor terminals.
Manipulation of apparatus	• Drawing the circuit diagram • Making the connections. • Checking the connections • Following standard procedures (Correct colour code, polarity, tight connections etc.,) • Selecting correct mode and range of signal generator , CRO, RPS and Multimeter. • Switching on the supply. • Observing the readings in CRO and Signal Generator.

Precise operations/Activities	• Connecting Signal Generator , RPS and CRO probes to the correct terminals. • Reading the resistor and Capacitor values. • By measuring the resistance values , identify the transistor terminals. • By measuring the resistance values , identify the transformer windings. • Record the input and output voltages at different frequencies from CRO. • Determine the Gain. • Plot the frequency response on Logarithmic graph sheet. • Interpreting the response.
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

2. TEACHING POINTS

Sl No	Teaching Point	Suggested Time-15 min
1.	Amplifier Principle	1
2.	Types of coupling	2
3.	Gain, gain formula	2
4.	Frequency response	2
5.	Transformer Principle	2
6.	Advantages of Transformer Coupling	2
7.	Applications of Transformer coupled amplifier	1
8.	Interpreting Name plate Details	1
9.	Precautions	2

PRECAUTIONS

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Ensure the correct range of meters
- Ensure that the meters are properly set
- Ensure that the Transistor and Transformer connected properly
- Connect the circuit as per the circuit diagram and check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Do not exceed the rated voltage
- Avoid parallax error

B. Safety precautions:

- Shoes must be worn at all times.
- No part of a live circuit should be touched by the bare hand.
- Always check to see that the power switch is **OFF** before plugging and unplugging from the outlet

3. NEED AND SCOPE OF EXPERIMENT

- This circuit is used where impedance matching is the main criteria.
- It can be used as Power amplifier.
- It can be used as Driver amplifier.
- Used in applications where maximum power transfer is needed

4. PLANNING AND ORGANISATION

ACTION	ACTIVITY
Check for	• CRO. RPS and Function Generator. • Transistor and Transformer arrangement. • The students entry behavior • First aid kit • Wires of Standard colours and Gauges
For Design of Instruction	• Read teaching points carefully.

5. SCHEME OF EVALUATION

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL (50)
1. Handling of apparatus	A. Identifying the equipment . B. Selecting correct components, meters and wires. C. Identification of Transformer terminals by markings. D. Identifying the transistor terminals.	A: 2, B: 2, C: 2, D: 2, T: 8	8

<table>
<tr><td>2. Manipulation of apparatus</td><td>A. Drawing the circuit diagram
B. Making the connections.
C. Following standard procedures (Correct colour code, polarity, tight connections etc.,)
D. Selecting correct mode and range of signal generator , CRO, RPS and Multimeter.
E. Observing the readings in CRO and Signal Generator.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>4</td><td>3</td><td>1</td><td>2</td><td>2</td><td>12</td></tr></table></td><td>12</td></tr>
<tr><td>3.Precise operations / Activities</td><td>A. Connecting Signal Generator , RPS and CRO probes to the correct terminals.
B. By measuring the resistance values , identify the transistor terminals
C. By measuring the resistance values , identify the transformer winding
D. Record the input and output voltages at different frequencies from CRO
E. Determine the Gain
F. Plot the frequency response on Logarithmic Graph sheet
G. Interpreting the response</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>T</td></tr><tr><td>5</td><td>3</td><td>2</td><td>5</td><td>4</td><td>4</td><td>2</td><td>25</td></tr></table></td><td>25</td></tr>
<tr><td>4.Values</td><td>A. Co Operation
B. Co-Ordination
C. Communication
D. Sharing
E. Leadership</td><td>5</td><td>5</td></tr>
<tr><td colspan="2"></td><td>Total</td><td>50</td></tr>
</table>

6. ASSESSMENT / VIVA QUESTIONS:

1. Why transformer coupling is preferred than other coupling methods in amplifiers?
2. State the need for coupling.
3. Why CE Configured amplifier is preferred ?
4. How the transformer provides impedance matching?
5. What is the need for impedance matching?
6. Why the frequency response is not stable in transformer coupled amplifiers?
7. Mention the disadvantages of transformer coupled amplifiers.

2.8 FREQUENCY RESPONSE OF A RC COUPLED AMPLIFIER LAB SHEET

FREQUENCY RESPONSE CHARACTERISTICS OF A RC COUPLED AMPLIFIER

1. OBJECTIVE:

a) To study the frequency response of a RC coupled amplifier.
b) To calculate gain and bandwidth of a RC coupled amplifier.

2. APPARATUS REQUIRED:

EQUIPMENT	RANGE	TYPE	NUMBER
Regulated power supply	0-30V		1
Breadboard			1
Resistor	33KΩ, 2.2KΩ, 1KΩ, 10KΩ,5.6KΩ	Carbon	2each
CRO			1
Transistor		BC107	2
Capacitors	4.7µf/12V	Electrolytic	5
Patch cords		Single lead	few

3. TASK ANALYSIS:

A. KNOWLEDGE

1. Transistor terminal identification.
2. Biasing
3. Identification of low, medium and high frequencies.
4. Gain and Bandwidth.

B. SKILLS

CATEGORY OF SKILL	SUBTASK
Handling apparatus	a) Identifying different solid state devices b) Identification of test points in circuit. c) Identifying different components
Manipulations of apparatus	a) Designing Circuit b) Choosing proper values of resistor, regulated power supply. c) Identifying proper terminals of transistor. d) Proper connections as per the circuit
Precise operations/activities	a) Identifying breakdown voltages from data sheet. b) Identifying cut off , saturation and active regions of BC107 transistor. c) Plot the frequency response on semi log sheet. d) Calculate the gain and bandwidth

4. TEACHING POINTS:

S.No	Teaching point	Time allocation
1.	About Doping	1min
2.	Different junctions in a transistor	1min
3.	Forward bias and reverse bias	1min
4.	Breakdown voltage and cut in voltage	1min
5.	Identifying different models of transistor.	2min
6.	Identifying the rating of the given transistor.	2min
7.	Identifying different types of resistors and their ratings	2min
8.	Define voltage gain.	1min
9.	Applications of RC coupled amplifier	2min

5. PRECAUTIONS:

Precautions to be followed as mention in the annexure:

1. While performing the experiment do not exceed the ratings of the transistor. This may lead to damage the transistor.
2. Do not switch ON the power supply unless you have checked the circuit connections as per the circuit diagram.
3. Make sure while selecting the emitter, base and collector terminals of the transistor.

6. SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUBTASK	WEITAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Handling apparatus	a) Identification of components b) Identification of meters	A: 2, B: 3, T: 5
Manipulations of apparatus	a) Circuit connections b) Equipment handling c) Measurements and observations	A: 4, B: 8, C: 8, T: 20
Precise operations/activities	a) Identifying proper components b) Identifying the ratings of the components c) Identifying terminals of a transistor. d) Plot the frequency of a given amplifier. e) Calculate the gain and bandwidth from the graph	A: 5, B: 5, C: 5, D: 5, E: 5, T: 20
values	a) Co-operation b) Co-ordination c) Communication d) Attitude e) leadership	T: 5
		TOTAL

2.6.7 ASSESSMENT QUESTIONS:

1. Identify terminals of a BC 107 transistor.
2. Make connections as per the circuit diagram.
3. Adjust the waveform in the CRO.
4. Check the voltage levels in the circuit.

2.6.8 VIVA QUESTIONS:

1. Which region is having highest doping density?
2. What is voltage gain?
3. How many junctions are there in a transistor?
4. What are the modes of operation in a transistor?
5. When the temperature increases what happens to the collector current?
6. Why the width of the base is narrow?
7. What is regions of a RC coupled amplifier
8. Why we are preferring NPN transistors compared to PNP?

COLPITTS OSCILLATOR

1.OBJECTIVE

b) To implement the Colpitt's oscillator
c) To verify the effect of varying the tank circuit component values and observe output waveform on CRO.

2.APPARATUS

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	TRANSISTOR	BC107BP	1	For amplification
2	RESISTOR	R_1 =100K ohms R_2 , R_4 =10K ohms R_e = 1K ohms	1 2 1	For biasing and stabilization
3	CAPACITORS	C1,C2 =0.1uf	2	For tank circuit
4	CAPACITORS	Cin, Cout =10uf	2	For in blocking and coupling capacitor
5	CAPACITORS	Ce = 100pf	1	Emitter bypass capacitor
6	INDUCTOR	L1 = 2mH	1	For tank circuit
7	CRO	0-20 M HZ	1	For observing the output waveforms
8	BREADBOARD		1	To Develope the circuit
9	CONNECTING WIRES		REQUIRED NUMBER	
10	REGULATED POWERSUPPLY	0-30V	1	To provide biasing

3.TASK ANALYSIS

A. KNOWLEDGE

1. Common emitter amplifier
2. Working Principle of Tank circuit
3. Condition for sustained oscillations
4. Equation for the frequency of Oscillations of Colpitt's Oscillator

B. SKILLS

S.NO	CATEGORY OF SKILL	SUBTASK
1	Handling apparatus	a) Drawing the circuit diagram b) Identification of Components c) Identification of terminals of the transistor d) Identifying major sections (amplifier & Feedback section) e) Identification of test points in circuit.
2	Manipulations of apparatus	a) Make the connections as per the Circuit. b) Check the proper function of the CRO c) Adjust the appropriate voltage level in Dual regulated power supply d) Observe the output waveform on CRO at the test point in the circuit.
3	Precise operations/activities	a) Adjust the capacitance and inductance of the tank circuit to get the sustained oscillations b) Note down the time period and amplitude of the output waveform c) Plotting output waveform on graph sheet d) Calculate the frequency of oscillations from the output waveform e) Verify the theoretical and practical frequencies.
4	Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

4.TEACHING POINTS:

S.No	Teaching point	Time allocation
1.	Different junctions in a transistor	1min
2.	Region of operation of the transistor	2min
3.	Transistor as amplifier	3min
4.	Working principle of tank circuit	2min
5.	Concept of positive feedback	2min
6.	Constructional details of the colpitt's oscillator	2min
7.	Conditions for sustained oscillations	2min
8.	Calculations of the frequency of colpitt's Oscillator	1min

5. NEED& SCOPE:

- Colpitt's oscillator is mainly used to generate the stable sinusoidal Waveform with different frequencies.
- It is used for the development of mobile and radio communications.

6. PLANNING AND ORGANIZATION:

ACTION	ACTIVITY
Check for	• Circuit components • CRO with probes • Connecting Wires • Students entry behavior • First aid kit
For Design of Instruction	• Read teaching points carefully.

7. SCHEME OF EVALUATION:

Category of skill	Subtask	Weightage With Competency Level Individually	Total
Handling apparatus	a. Drawing the circuit diagram b. Identification of Components c. Identification of terminals of the transistor d. Identifying major sections (amplifier & Feedback section) e. Identification of test points in circuit.	A B C D E T 1 1 1 1 1 5	
Manipulations of apparatus	a. Make the connections as per the Circuit. b. Check the proper function of the CRO c. Adjust the appropriate voltage level in Dual regulated power supply d. Observe the output waveform on CRO at the test point in the circuit.	A B C D T 8 2 2 3 15	
Precise operations/activities	a) Adjust the capacitance and inductance of the tank circuit to get the sustained oscillations b) Note down the time period and amplitude of the output waveform c) Plotting output waveform on graph sheet d) Calculate the frequency of oscillations from the output waveform e) Verify the theoretical and practical frequencies.	A B C D E T 5 5 5 5 5 25	
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	A B C D E T 1 1 1 1 1 5	

8. ASSESSMENT / VIVA QUESTIONS:

1. What type of feedback is preferred in oscillators?
2. List out the applications of Colpitt's oscillators
3. why Amplifier circuit is necessary in an oscillator?
4. What is the feedback factor for colpittsOscillator
5. whypositive feedback is employed in oscillators?
6. What is the formula for frequency of oscillations?
7. What are the elements in feedback circuit?

HARTLEY OSCILLATOR

1. OBJECTIVE:

a) To implement the Hartley oscillator
b) To verify the effect of varying the tank circuit component values and observe output waveform on CRO.

2. TASK ANALYSIS:

A. KNOWLEDGE

1. Common emitter amplifier
2. Working Principle of Tank circuit
3. Condition for sustained oscillations
4. Equation for the frequency of Oscillations of Hartley Oscillator

B. SKILLS

S.NO	CATEGORY OF SKILL	SUBTASK
1	Handling apparatus	a) Drawing the circuit diagram b) Identification of Components c) Identification of terminals of the transistor d) Identifying major sections (amplifier & Feedback section) e) Identification of test points in circuit.
2	Manipulations of apparatus	a) Make the connections as per the Circuit. b) Check the proper function of the CRO c) Adjust the appropriate voltage level in Dual regulated power supply d) Observe the output waveform on CRO at the test point in the circuit.
3	Precise operations/activities	a) Adjust the capacitance and inductance of the tank circuit to get the sustained oscillations b) Note down the time period and amplitude of the output waveform c) Plotting output waveform on graph sheet d) Calculate the frequency of oscillations from the output waveform e) Verify the theoretical and practical frequencies.
4	Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

3. TEACHING POINTS :

S.No	Teaching point	Time allocation
1.	Different junctions in a transistor	1min
2.	Region of operation of the transistor	2min
3.	Transistor as amplifier	3min
4.	Working principle of tank circuit	2min
5.	Concept of positive feedback	2min
6.	Constructional details of the Hartley oscillator	2min
7.	Conditions for sustained oscillations	2min
8.	Calculations of the frequency of Hartley Oscillator	1min

4. PRECAUTIONS:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure that the variable inductors and capacitors are properly adjusted
- Ensure the correct position of different knobs on the CRO
- Get the connections checked
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions

- Keep workbench clear by placing extra items(books ,bags etc…) on shelves
- Wear sensible clothing including footwear
- Do not switch on the power supply while making connections

5. NEED & SCOPE :

- Hartley oscillator is mainly used to generate the stable sinusoidal Waveform with different frequencies.
- It is used for the development of mobile and radio communications.

6. PLANNING AND ORGANIZATION:

ACTION	ACTIVITY
Check for	• Circuit components • CRO with probes • Connecting Wires • Students entry behavior • First aid kit
For Design of Instruction	• Read teaching points carefully.

7. SCHEME OF EVALUATION:

<table>
<tr><th>CATEGORY OF SKILL</th><th>SUBTASK</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th><th>TOTAL</th></tr>
<tr><td>Handling apparatus</td><td>a. Drawing the circuit diagram
b. Identification of Components
c. Identification of terminals of the transistor
d. Identifying major sections (amplifier & Feedback section)
e. Identification of test points in circuit.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table></td><td></td></tr>
<tr><td>Manipulations of apparatus</td><td>a. Make the connections as per the Circuit.
b. Check the proper function of the CRO
c. Adjust the appropriate voltage level in Dual regulated power supply
d. Observe the output waveform on CRO at the test point in the circuit.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>8</td><td>2</td><td>2</td><td>3</td><td>15</td></tr></table></td><td></td></tr>
<tr><td>Precise operations/activities</td><td>a) Adjust the capacitance and inductance of the tank circuit to get the sustained oscillations
b) Note down the time period and amplitude of the output waveform
c) Plotting output waveform on graph sheet
d) Calculate the frequency of oscillations from the output waveform
e) Verify the theoretical and practical frequencies.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr></table></td><td></td></tr>
<tr><td>Values</td><td>• Co-operation
• Co-ordination
• Communication
• Sharing
• Leadership</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table></td><td></td></tr>
</table>

8. ASSESSMENT / VIVA QUESTIONS:

1. What type of feedback is preferred in oscillators?
2. List out the applications of Hartley oscillators
3. Why Amplifier circuit is necessary in an oscillator?
4. What is the feedback factor for Hartley Oscillator?
5. Why positive feedback is employed in oscillators?
6. What is the formula for frequency of oscillations?
7. What are the elements in feedback circuit?

CRYSTAL OSCILLATOR

1. OBJECTIVE :

a) To implement the Crystal oscillator
b) To verify the effect of varying the tank circuit component values and observe output waveform on CRO.

2. TASK ANALYSIS:

A. KNOWLEDGE

1. Common emitter amplifier
2. Working Principle of Tank circuit
3. Condition for sustained oscillations
4. Equation for the frequency of Oscillations of Crystal Oscillator

B. SKILLS

S.NO	CATEGORY OF SKILL	SUBTASK
1	Handling apparatus	a) Drawing the circuit diagram b) Identification of Components c) Identification of terminals of the transistor d) Identifying major sections (amplifier & Feedback section) e) Identification of test points in circuit.
2	Manipulations of apparatus	a) Make the connections as per the Circuit. b) Check the proper function of the CRO c) Adjust the appropriate voltage level in Dual regulated power supply d) Observe the output waveform on CRO at the test point in the circuit.
3	Precise operations/activities	a) Adjust the capacitance and Crystal of the tank circuit to get the sustained oscillations b) Note down the time period and amplitude of the output waveform c) Plotting output waveform on graph sheet d) Calculate the frequency of oscillations from the output waveform e) Verify the theoretical and practical frequencies.
4	Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

3. TEACHING POINTS :

S.NO	TEACHING POINT	TIME ALLOCATION
1.	Different junctions in a transistor	1min
2.	Region of operation of the transistor	2min
3.	Transistor as amplifier	3min
4.	Working principle of tank circuit	2min
5.	Concept of positive feedback	2min
6.	Constructional details of the Crystal oscillator	2min
7.	Conditions for sustained oscillations	2min
8.	Calculations of the frequency of hartley Oscillator	1min

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure that the variable inductors and capacitors are properly adjusted
- Ensure the correct position of different knobs on the CRO
- Get the connections checked
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions

- Keep workbench clear by placing extra items(books ,bags etc…) on shelves
- Wear sensible clothing including footwear
- Do not switch on the power supply while making connections

4.NEED & SCOPE:

- Crystal oscillator is mainly used to generate the stable sinusoidal Waveform with different frequencies.
- It is used for the development of mobile and radio communications.

5. PLANNING AND ORGANIZATION:

ACTION	ACTIVITY
Check for	• Circuit components • CRO with probes • Connecting Wires • Students entry behavior • First aid kit
For Design of Instruction	• Read teaching points carefully.

6. SCHEME OF EVALUATION:

<table>
<tr><th>CATEGORY OF SKILL</th><th>SUBTASK</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th><th>TOTAL</th></tr>
<tr><td>Handling apparatus</td><td>a. Drawing the circuit diagram
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<tr><td>Manipulations of apparatus</td><td>a. Make the connections as per the Circuit.
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c. Adjust the appropriate voltage level in Dual regulated power supply
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b) Note down the time period and amplitude of the output waveform
c) Plotting output waveform on graph sheet
d) Calculate the frequency of oscillations from the output waveform
e) Verify the theoretical and practical frequencies.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>25</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td><td></td></tr>
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</table>

7. ASSESSMENT / VIVA QUESTIONS :

1. What type of feedback is preferred in oscillators?
2. List out the applications of Crystal oscillators
3. why Amplifier circuit is necessary in an oscillator?
4. What is the feedback factor for Crystal Oscillator
5. why positive feedback is employed in oscillators?
6. What is the formula for frequency of oscillations?
7. What are the elements in feedback circuit?

RC PHASE SHIFT OSCILLATOR

OBJECTIVE:

i) To obtain the output waveforms of RC phase shift oscillator for different R,C Values

ii) To determine the frequency of oscillations for different values of R,C Values.

APPARATUS:

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY
1	TRANSISTOR	BC107BP	1
2	RESISTOR	4.7K ohms	2
3	RESISTOR	2.2K OHMS	1
4	VARIABLE RESISTOR	470K OHMS	1
5	CAPACITORS	0.1uf	3
6	CAPACITORS	10uf	1
7	CRO	0-20 M HZ	1
8	BREADBOARD		1
9	CONNECTING WIRES		REQUIRED NUMBER

1. TASK ANALYSIS

A. KNOWLEDGE

1. conditions for oscillations.
2. Need for oscillator.
3. Types of oscillators.
4. Expression for frequency of oscillations.
5. Applications.
6. Precautions.

B. SKILL

S.NO	CATEGORY OF SKILL	SUBTASK
1	Handling of Apparatus	• Drawing the circuit diagram • Identifying various components and terminals. • Proper handling of CRO to get exact waveforms
2	Manipulation of apparatus	• Reading the Circuit Diagram. • Making the connections as per circuit diagram. • Checking the connections • Connecting the CRO probes to correct terminals • Adjusting the CRO and variable resistor to get exact waveforms
3	Precise operations/Activities	• Measuring the amplitude and timeperiod of the output waveform • Calculating the frequency of the output waveform • Tabulating amplitude and timeperiod for different R,C values . • Drawing the ouput waveform on the graph sheet
4	Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership

2. TEACHING POINTS

S No	Teaching Point	Suggested Time-15 min
1.	Conditions for oscillations	3
2.	Need for oscillator	1
3.	Types of oscillators.	2
4.	Usage of CRO for obtaining output waveforms	3
5.	Expression for frequency of oscillations	1
6.	Calculation of frequency of oscillations	2
7.	Applications	2
8.	Precautions	1

PRECAUTIONS

A. PROCEDURAL PRECAUTIONS:

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure that the variable resistor is properly adjusted
- Ensure the correct position of different knobs on the CRO
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. SAFETY PRECAUTIONS:

- Keep workbench clear by placing extra items(books ,bags etc…) on shelves
- Wear sensible clothing including footwear
- Do not switch on the power supply while making connections

3. NEED AND SCOPE OF EXPERIMENT

- This experiment is used to generate low frequency sinusoidal waveform with good stability.
- These are used in musical instruments and voice synthesis and in GPS units since they work at all audio frequencies.

.4. PLANNING AND ORGANISATION

ACTION	ACTIVITY
Check for	• Circuit components • CRO with probes • Connecting Wires • Students entry behavior • First aid kit
For Design of Instruction	• Read teaching points carefully.

5. SCHEME OF EVALUATION

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL (50)
1. Handling of apparatus	• Drawing the circuit diagram • Identifying various components and terminals. • Proper handling of CRO to get exact waveforms	A: 3, B: 1, C: 1, T: 5	
2. Manipulation of apparatus	A. Reading the Circuit Diagram. B. Making the connections as per circuit diagram. C. Checking the connections D. Connecting the CRO probes to correct terminals E. Adjusting the CRO and variable resistor to get exact waveforms	A: 1, B: 8, C: 1, D: 1, E: 4, T: 15	

<table>
<tr><td>3.Precise operations/Activities</td><td>Measuring the amplitude and time period of the output waveform
Calculating the frequency of the output waveform
Tabulating amplitude and time period for different R,C values .
Drawing the ouput waveform on the graph sheet.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>7</td><td>6</td><td>6</td><td>6</td><td>25</td></tr></table></td><td></td></tr>
<tr><td>4.Values</td><td>A. Co Operation
B. Co-Ordination
C. Communication
D. Leadership
E. Sharing</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr></table></td><td></td></tr>
<tr><td colspan="2">Total</td><td>50</td><td></td></tr>
</table>

6. ASSESSMENT / VIVA QUESTIONS:

1. List the conditions for oscillations.
2. State the need for an oscillator
3. Classify oscillators.
4. Write the expression for frequency of oscillations
5. Mention the applications of RC Phase shift oscillators
6. Why 3 RC sections are used in RC Phase shift oscillator?

HALFWAVE RECTIFIER SIMULATION

OBJECTIVE:

1. To design and simulate the half wave rectifier
2. To observe the output waveforms of Half Wave Rectifier

APPARATUS:

Step-down Transformer (230V/ 9-0-9V) ,
Diode IN4007 ,
Resistor 1kohm
Voltage marker.
AC voltage source.

1. TASK ANALYSIS:

A.KNOWLEDGE

1. Main purpose of rectifier
2. Working principle of PN diode in forward bias and reverse bias.
3. Familiarization of simulation software.
4. Applications of rectifier.
5. Output waveforms
6. Precautions

B. SKILL

Category of skill	Subtask
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B)Identifying major sections C) Identification of test points in circuit
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.
Simulation and result analysis	A. Run the simulation and rectiify the errors if any by modifying the connections B. Measuring the no load voltage. C.Recording the readings in the Ammeter,Voltmeters D.Calculating Ripple factor and percentage of regulation E.Observing the waveforms F. Drawing the Graph
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership
	TOTAL

Handling of Apparatus	A. Opening the PSPICE schematic. B. Creating a new File. C. Getting the required components and Devices from PSPICE library.
Manipulation of apparatus	A. Giving values/names to the components. B. Making the circuit connection with wire. C. Placing Ac voltage source at input. D. Placing voltage marker at the output..
Precise operations/Activities	A. Setting The values of primary , secondary of Transformer B .Applying AC voltage to the primary of the transformer. C. Run the simulation D. Observing the output waveforms. E. Measuring the amplitude and time period by using scales. F. Drawing the graph.

2. TEACHING POINTS

Sl No	Teaching Point	Suggested Time-15 min
1.	Purpose of rectifier	2
2.	Types of rectifiers	1
3.	Familiarization of simulation software	5
4.	Familiarization of scales in CRO	2
5.	Simulation running process	2
6.	Input and Output wave forms	1
7.	Applications of Half wave rectifier	1
8.	Precautions	1

A. Procedural precautions:

- The primary and secondary of the transformer should be correct values.
- The polarities of the diode should be carefully connected.
- Connect the circuit as per circuit diagram.
- Get the connections checked by the concerned staff member.
- Ensure whether selected the correct analysis in setup.

B. Safety precautions:

1. Care must be taken while operating the equipment / PC.

3. NEED AND SCOPE OF EXPERIMENT

This experiment helps to understand the performance characteristics of half wave rectifier

Half wave rectifiers are used in power supplies.

4. PLANNING AND ORGANISATION

ACTION	ACTIVITY
Check for	• Check for availability and suitability of the components and devices in the PSPICE schematic Library. • Students entry behavior
For Design of Instruction	• Read teaching points carefully.

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5. SCHEME OF EVALUATION

CATEGORY OF SKILL	SUBTASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL (50)
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software'sPC simulation softwares B)Identifying major sections C) Identification of test points in circuit	A: 1, B: 1, C: 3, T: 5	
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	A: 5, B: 6, C: 2, D: 2, T: 15	
Simulation and result analysis	A. Run the simulation and rectiify the errors if any by modifying the connections B. Measuring the no load voltage. C.Recording the readings in the Ammeter ,Voltmeters D.Calculating Ripple factor and percentage of regulation E.Observing the waveforms F. Drawing the Graph	A: 2, B: 2, C: 5, D: 10, E: 6, T: 25	
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	5	
Total		50	

6. ASSESSMENT / VIVA QUESTIONS:

1. What is rectifier?
2. List the types of rectifier
3. List the applications of Half wave rectifier

FULLWAVE RECTIFIER SIMULATION

OBJECTIVE:

1. To design and simulate the Full wave rectifier
2. To observe the output waveforms of Full Wave Rectifier

APPARATUS:

Step-down Transformer (230v/ 9-0-9V) ,

Diode 1N4007 ,

1 Kohm Resistor,

CRO

Function generator

1. TASK ANALYSIS:

A.KNOWLEDGE

1. Main purpose of rectifier
2. Working principle of PN diode in forward bias and reverse bias.
3. Familiarization of simulation software.
4. Applications of rectifier.
5. Output waveforms
6. Precautions

B. SKILL

CATEGORY OF SKILL	SUBTASK
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B)Identifying major sections C) Identification of test points in circuit
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.
Simulation and result analysis	A. Run the simulation and rectiify the errors if any by modifying the connections B. Measuring the no load voltage. C.Recording the readings in the Ammeter ,Voltmeters D.Calculating Ripple factor and percentage of regulation E.Observing the waveforms F. Drawing the Graph
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership

2. TEACHING POINTS

Sl No	Teaching Point	Suggested Time-15 min
1.	Purpose of rectifier	2
2.	Types of rectifiers	1
3.	Familiarization of simulation software	5
4.	Familiarization of scales in CRO	2
5.	Simulation running process	2
6.	Input and Output wave forms	1
7.	Applications of Full wave rectifier	1
8.	Precautions	1

A. Procedural precautions:

- The primary and secondary of the transformer should be correct values.
- The polarities of the diode should be carefully connected.
- Connect the circuit as per circuit diagram.
- Get the connections checked by the concerned staff member.
- Ensure whether selected the correct analysis in setup.

C. Safety precautions:

1. Care must be taken while operating the equipement / PC.

3. NEED AND SCOPE OF EXPERIMENT

- This experiment helps to understand the performance characteristics of Full wave rectifier .
- Full wave rectifiers are used in Regulated power supply.

4. PLANNING AND ORGANISATION

For Design of Instruction	• Read teaching points carefully.

5. SCHEME OF EVALUATION

<table>
<tr><th>CATEGORY OF SKILL</th><th>SUBTASK</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th></tr>
<tr><td>Familiarization of PSPICE software/Multisim</td><td>A) Working with Desktop PC simulation software'sPC simulation softwares
B)Identifying major sections
C) Identification of test points in circuit</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>2</td><td>2</td><td>1</td><td>5</td></tr><tr><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Preparation of schematic using PSPICE</td><td>A. Identification of various tool box and Workspace
B.Select the required components from the respectivegroup of library
C. Set the values of components as per the requirement
D. Make the connections as per the Circuit inworkspace.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>4</td><td>3</td><td>3</td><td>5</td><td>15</td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Simulation and result analysis</td><td>A. Run the simulation and rectiify the errors if anyby modifying the connections
B. Measuring the no load voltage.
C.Recording the readings in the Ammeter, Voltmeters
D.Calculating Ripple factor and percentage of Regulation
E.Observing the waveforms
F. Drawing the Graph</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>T</td></tr><tr><td>5</td><td>5</td><td>4</td><td>6</td><td>3</td><td>2</td><td>25</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Values</td><td>A)Co-operation
B)Co-ordination
C)Communication
D)Sharing
E)Leadership</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td></td><td>TOTAL</td><td>50</td></tr>
</table>

6. ASSESSMENT / VIVA QUESTIONS :

1. What is rectifier?
2. List the types of rectifier
3. List the applications of Full wave rectifier

2.14. ZENER REGULATOR LAB SHEET

ZENER VOLTAGE REGULATOR

OBJECTIVE:

To Implement 12V Zener voltage regulator for various loads circuit using PSPICE Schematic.

APPARATUS:

1.Zener diode (1N963B) / 12V	1no
2. Resistor (500Ω)	1no
3.DC power supply (0-30V)	1no
4.Current marker	1no
5.Voltage marker	2no
6.Variable resistor (1-20k)	1no
7.Wire.	--

1.TASK ANALYSIS

A. KNOWLEDGE

1.Basic knowledge about computer.
2.voltage regulator.
3.Zener breakdown voltage.
4.Unregulated and Regulated voltage..
5.Basic knowledge about PSPICE schematic.
6.Applications.

B. SKILL

CATEGORY OF SKILL	SUBTASK
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B)Identifying major sections (amplifier & Feedback section) C) Identification of test points in circuit
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B. Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.
Simulation and result analysis	A. Run the simulation and rectify the errors if any by modifying the connections B. Adjusting the RPS to minimum position and maximum position as to get the required voltage. C. Recording and observing the readings on voltmeter, Ammeter. D. Finding Breakdown voltage or output voltage. E. Calculating the regulation of the Zener Diode. F. Drawing the graphs.
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership

2. TEACHING POINTS

Sl No	Teaching Point	Time allocation (Suggestive) 15min
1	Purpose of zener voltage regulator.	4
2	Changing the values of PSPICE components.	
3	Importance of voltage marker.	
4	Importance of current marker.	
5	DC sweep Analysis in setup.	8
6	Line regulation and load regulation.	
7	Changing the axis parameters.	
8	Adding the traces.	3
9	Changing the colors of waveforms.	
10	Precautions.	

A. Procedural precautions.

1. Ensure correct values of resistors.

2.Ensure the correct input voltage while doing load regulation.

3. Connecting the circuit as per the circuit diagram.4

4.Get the connections checked by the concerned staff member.

5.Ensure whether selected the correct analysis in setup.

B.Safety precautions.

1.Care must be taken while operating the equipment/PC.

2.Wear shoes for the lab.

3. NEED AND SCOPE OF EXPERIMENT.

This experiment is essential to understand the regulation characteristics of zenerdiode.Thiszener regulator is used in many of the electrical/electronic circuits where constant voltage is required.

4. PLANNING AND ORGANIZATION:

Action	Activity
Check for	➢ Check for availability and suitability of the components and devices in the PSPICE schematic Library. ➢ The student entry behavior. ➢ Availability of first aid kit.
For design of instruction	❖ Read the teaching points carefully.

5.Scheme of Evaluation:

CATEGORY OF SKILL	SUBTASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software PC simulation softwares B)Identifying major sections (amplifier & Feedbacksection) C) Identification of test points in circuit	A B C T 2 2 1 5
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	A B C D T 4 3 3 5 15
Simulation and result analysis	A. Run the simulation and rectify the errors if any bymodifying the connections B. Adjusting the RPS to minimum position and maximum position as to get the required voltage.	A B C D E F T

	C. Recording and observing the readings on voltmeter, Ammeter. D. Finding Breakdown voltage or output voltage. E. Calculating the regulation of the Zener Diode. F. Drawing the graphs	5 5 4 6 3 2 25
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	A B C D E T 1 1 1 1 1 5

6. ASSESSMENT / VIVA QUESTIONS:

1.Why is the zener diode used as a voltage regulator.

2.How zener diode maintains constant voltage across the load.

3.What is meant by temperature coefficient.

4.What is DC sweep analysis.

5.How to model the variable resistor in PSPICE schematic.

COMMON EMITTER AMPLIFIER

OBJECTIVE:

(i) To Design Transistor CE amplifier and simulating in PSPICE Schematic and find its voltage gain
(ii) Observe the output waveforms on CRO and the effect of disconnecting bypass capacitor.

APPARATUS:

a) PSPICE SOFTWARE
b) Personal computer
c) printer

TASK ANALYSIS:

A. KNOWLEDGE

1. Basic knowledge about computer.
2. Voltage gain.
3. Working of CE. Amplifier
4. Basic knowledge about PSPICE schematic.
5. Applications.

B. SKILL

Category of skill	Subtask
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B)Identifying major sections (amplifier) C) Identification of test points in circuit
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B. Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in Workspace.
Simulation and result analysis	A. Run the simulation and rctify the errors if any by modifying the connections B Note down the time period and amplitude of the output Waveform with capacitor C. Plotting output waveform on graph sheet D. Note down the time period and amplitude of the output Waveform without capacitor E. Plotting output waveform on graph sheet F. Note down the time period and amplitude of the output Waveform with capacitor
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership

2. TEACHING POINTS:

Sl No.	Teaching Points	Suggested Time(15Min)
1.	Classification of Amplifiers	1
2.	Working of Common Emitter Amplifier	3
3	Need of Bypass capacitor	2
4.	Working of Bypass capacitor	3
5.	Output Voltage in Common Emitter Amplifier	1
6.	Applications	2
7.	Changing the voltage and time in function generator	1
8.	Precautions	2

3.

A) Procedural precautions.

1. Ensure correct values of resistors.
2. Ensure the correct input voltage.
3. Connecting the circuit as per the circuit diagram
4. Get the connections checked by the concerned staff member.
5. Ensure whether selected the correct analysis in setup.

B) Safety precautions.

1. Care must be taken while operating the equipment/PC.
2. Wear shoes for the lab.
3. Need and scope of experiment.

This experiment is essential to understand the characteristics of Common Emitter Amplifier. This Common Emitter Amplifier is used in many of the electronic circuits where amplification is required.

4. PLANNING AND ORGANIZATION:

Action	Activity
Check for	➢ Check for availability and suitability of the components and devices in the PSPICE schematic Library. ➢ The student entry behavior. ➢ Availability of first aid kit.
For design of instruction	❖ Read the teaching points carefully.

5. SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUBTASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software PC simulation softwares B)Identifying major sections (amplifier) C) Identification of test points in circuit	A B C T 2 2 1 5
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B. Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	A B C D T 4 3 3 5 15
Simulation and result analysis	A. Run the simulation and rectify the errors if any by modifying the connections B. Note down the time period and amplitude of the output Waveform with capacitor C. Plotting output waveform on graph Sheet D. Note down the time period and amplitude of the output Waveform with out capacitor E. Plotting output waveform on graph sheet F. Note down the time period and amplitude of the output Waveform with capacitor	A B C D E F T 5 5 4 6 3 2 25
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	A B C D E T 1 1 1 1 1 5

6. VIVA QUESTIONS:

1. What is phase difference between input and output waveforms of CE amplifier?
2. What type of biasing is used in the above given circuit?
3. If the given transistor is replaced by a p-n-p, can we amplify the signals and explain?
4. What is effect of emitter-bypass capacitor on frequency response?
5. What is the effect of coupling capacitor?
6. What is the region of the transistor so that it can be operated as an amplifier?
7. How does transistor acts as an amplifier?
8. Draw the h-parameter model of CE amplifier?
9. What type of transistor configuration is used in intermediate stages of a multistage amplifier?
10. What is early effect?
11. How to model the variable resistor in PSPICE schematic.

2.16. SIMULATION OF RC PHASE SHIFT OSCILLATOR LAB SHEET

RC PHASE SHIFT OSCILLATOR

OBJECTIVE:

(i) To Design RC phase shift oscillator and simulate in PSPICE Schematic and find its frequency
(ii) Observe the output waveforms on CRO with different RC values.

APPARATUS:

a) PSPICE SOFTWARE

b) Personal computer

1. TASK ANALYSIS:

A. KNOWLEDGE

1. Basic knowledge about computer.
2. Frequency of an oscillator.
3. Working of RC phase shift oscillator
4. Effect of RC on frequency of a RC phase shift oscillator.
4. Basic knowledge about PSPICE schematic.
5. Applications.

B. SKILL

Category of skill	Subtask
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B) Identifying major sections (amplifier & Feedback section) C) Identification of test points in circuit
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.
Simulation and result analysis	A. Run the simulation and rctify the errors if any by modifying the connections B. Adjust the capacitance and resistance values of the tank circuit to get the sustained oscillations C. Note down the time period and amplitude of the output waveform D. Plotting output waveform on graph sheet E. Calculate the frequency of oscillations from the output waveform F. Verify the theoretical and practical frequencies.

Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership

2. TEACHING POINTS:

Sl No.	Teaching Points	Suggested Time(15Min)
1.	Classification of Oscillators	2
2.	Working of RC phase shift oscillator	5
3	Frequency of RC phase shift oscillator	1
4.	Measurement of frequency in oscillator	2
5.	Effect of RC on frequency	1
6.	Applications	1
7.	Changing the R & C values in PSPICE	1
8.	Precautions	2

3.

A) PROCEDURAL PRECAUTIONS

1. Ensure correct values of resistors.
2. Ensure correct values of capacitors.
3. Ensure correct input DC voltage.
4. Connecting the circuit as per the circuit diagram
4. Get the connections checked by the concerned staff member.
5. Ensure whether selected the correct analysis in setup.

B) SAFETY PRECAUTIONS.

1. Care must be taken while operating the equipment/PC.
2. Wear shoes for the lab.
3. Need and scope of experiment.

This experiment is essential to understand the working of RC phase shift oscillator. This phase shift oscillator is used to generate the signals over an extensive range of frequency. They used in musical instruments, GPS units, & voice synthesis.

4. PLANNING AND ORGANIZATION:

Action	Activity
Check for	➢ Check for availability and suitability of the components and devices in the PSPICE schematic Library. ➢ The student entry behavior. ➢ Availability of first aid kit.
For design of instruction	❖ Read the teaching points carefully.

5. SCHEME OF EVALUATION:

CATEGORY OF SKILL	SUBTASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B)Identifying major sections (amplifier & Feedback section) C) Identification of test points in circuit	A: 2, B: 2, C: 1, T: 5
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	A: 4, B: 3, C: 3, D: 5, T: 15
Simulation and result analysis	A. Run the simulation and rectify the errors if any by modifying the connections B.Adjust the capacitance and inductance values of the tank circuit to get the sustained oscillations C. Note down the time period and amplitude of the output waveform D. Plotting output waveform on graph sheet E. Calculate the frequency of oscillations from the output waveform F. Verify the theoretical and practical frequencies.	A: 5, B: 5, C: 4, D: 6, E: 3, F: 2, T: 25
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	A: 1, B: 1, C: 1, D: 1, E: 1, T: 5

6. VIVA QUESTIONS:

1. 1. List the conditions for oscillations.
2. State the need for an oscillator
3. Classify oscillators.
4. Write the expression for frequency of oscillations
5. Mention the applications of RC Phase shift oscillators
6. Why 3 RC sections are used in RC Phase shift oscillator?
7. What is the effect of R C values on frequency?
8. How can you increase the frequency of the generated signal?
9. How to model the variable resistor in PSPICE schematic.
10. How do you measure the frequency of a signal in PSPICE?

2.17. HARTLEY OSCILLATOR **LAB SHEET**

HARTLEY OSCILLATOR CIRCUIT SIMULATION

1. OBJECTIVE:

a) To simulate the Hartley's oscillator Circuit using PSPICE or equivalent software
b) verify the effect of varying the tank circuit component values and observe the output waveform on CRO.

2. APPARATUS:

1) PSPICE SOFTWARE

2) Personal computer

3) Printer

Category of skill	Subtask
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B)Identifying major sections (amplifier & Feedback section) C) Identification of test points in circuit
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.
Simulation and result analysis	A. Run the simulation and rctify the errors if any by modifying the connections B.Adjust the capacitance and inductance values of the tank circuit to get the sustained oscillations C.Note down the time period and amplitude of the output waveform D.Plotting output waveform on graph sheet E.Calculate the frequency of oscillations from the output waveform F.Verify the theoretical and practical frequencies.
Values	A. Co-operation B. Co-ordination C. Communication D. Sharing E. Leadership

3. TASK ANALYSIS:

A. KNOWLEDGE

1. Common emitter amplifier.
2. Working Principle of Tank circuit.
3. Condition for sustained oscillations.
4. Equation for the frequency of Oscillations of Hartley Oscillator.
5. Familiar with Simulation Softwares like PSpice, Multisim and simulation procedures.

B. SKILLS

3. TEACHING POINTS:

S. No	Teaching point	Time allocation
1.	Different junctions in a transistor	1min
2.	Region of operation of the transistor	2min
3.	Transistor as amplifier	1min
4.	Working principle of tank circuit	1min
5.	Concept of positive feedback	2min
6.	Constructional details of the Hartley oscillator	2min
7.	Conditions for sustained oscillations	2min
8.	Calculations of the frequency of Hartley Oscillator	1min
9	Simulation softwares, Pspice, Multisim	3min

4. NEED & SCOPE:

- Hartley oscillator is mainly used to generate the stable sinusoidal Waveform with different frequencies.
- It is used for the development of mobile and radio communications.

5.PLANNING AND ORGANIZATION:

ACTION	ACTIVITY
Check for	• Circuit components • CRO with probes • Connecting Wires • Desktop PC working condition and connections • Students entry behavior • First aid kit
For Design of Instruction	• Read teaching points carefully.

6. SCHEME OF EVALUATION:

<table>
<tr><th>CATEGORY OF SKILL</th><th>SUBTASK</th><th>WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY</th></tr>
<tr><td>Familiarization of PSPICE software/Multisim</td><td>A) Working with Desktop PC simulation software PC simulationsoftwares
B)Identifying major sections (amplifier & Feedback section)
C) Identification of test points in circuit</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>T</td></tr><tr><td>2</td><td>2</td><td>1</td><td>5</td></tr><tr><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Preparation of schematic using PSPICE</td><td>A. Identification of various tool box and workspace
B.Select the required components from the respective group of library
C. Set the values of components as per the requirement
D. Make the connections as per the Circuit in workspace.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>T</td></tr><tr><td>4</td><td>3</td><td>3</td><td>5</td><td>15</td></tr><tr><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Simulation and result analysis</td><td>A. Run the simulation and rectify the errors if any by modifying the connections
B.Adjust the capacitance and inductance values of the tank circuit to get the sustained oscillations
C. Note down the time period and amplitude of the output waveform
D. Plotting output waveform on graph sheet
E. Calculate the frequency of oscillations from the output waveform
F. Verify the theoretical and practical frequencies.</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>T</td></tr><tr><td>5</td><td>5</td><td>4</td><td>6</td><td>3</td><td>2</td><td>25</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
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B)Co-ordination
C)Communication
D)Sharing
E)Leadership</td><td><table><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>T</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>5</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
</table>

7. ASSESSMENT / VIVA QUESTIONS:

1. What type of feedback is preferred in oscillators?
2. List out the applications of Hartley oscillators?
3. Why an Amplifier circuit is necessary in an oscillator?
4. What is the feedback factor for Hartley Oscillator?
5. Why positive feedback is employed in oscillators?
6. What is the formula for frequency of oscillations?
7. What are the elements in feedback circuit?

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment : _____

2. Objective of the Experiment : _____

3. Equipment Required : _____

_____

4. Circuit Diagram:

5. Procedure:

6. Readings :

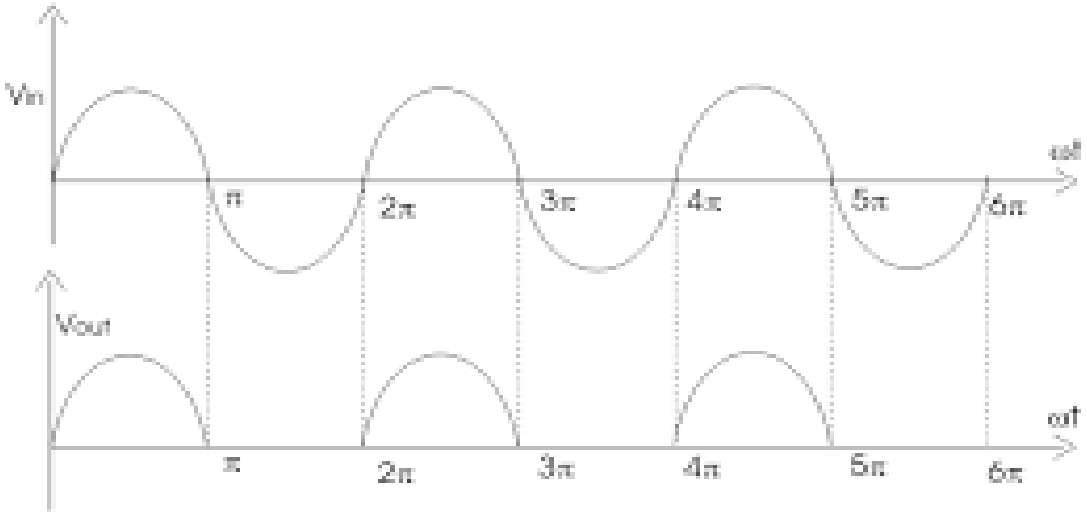
Without filter:

S.No	DC current Idc (mA)	DC Voltage Vdc (V)	AC voltage Vac (V)	Ripple factor = Vac / Vdc	% of regulation

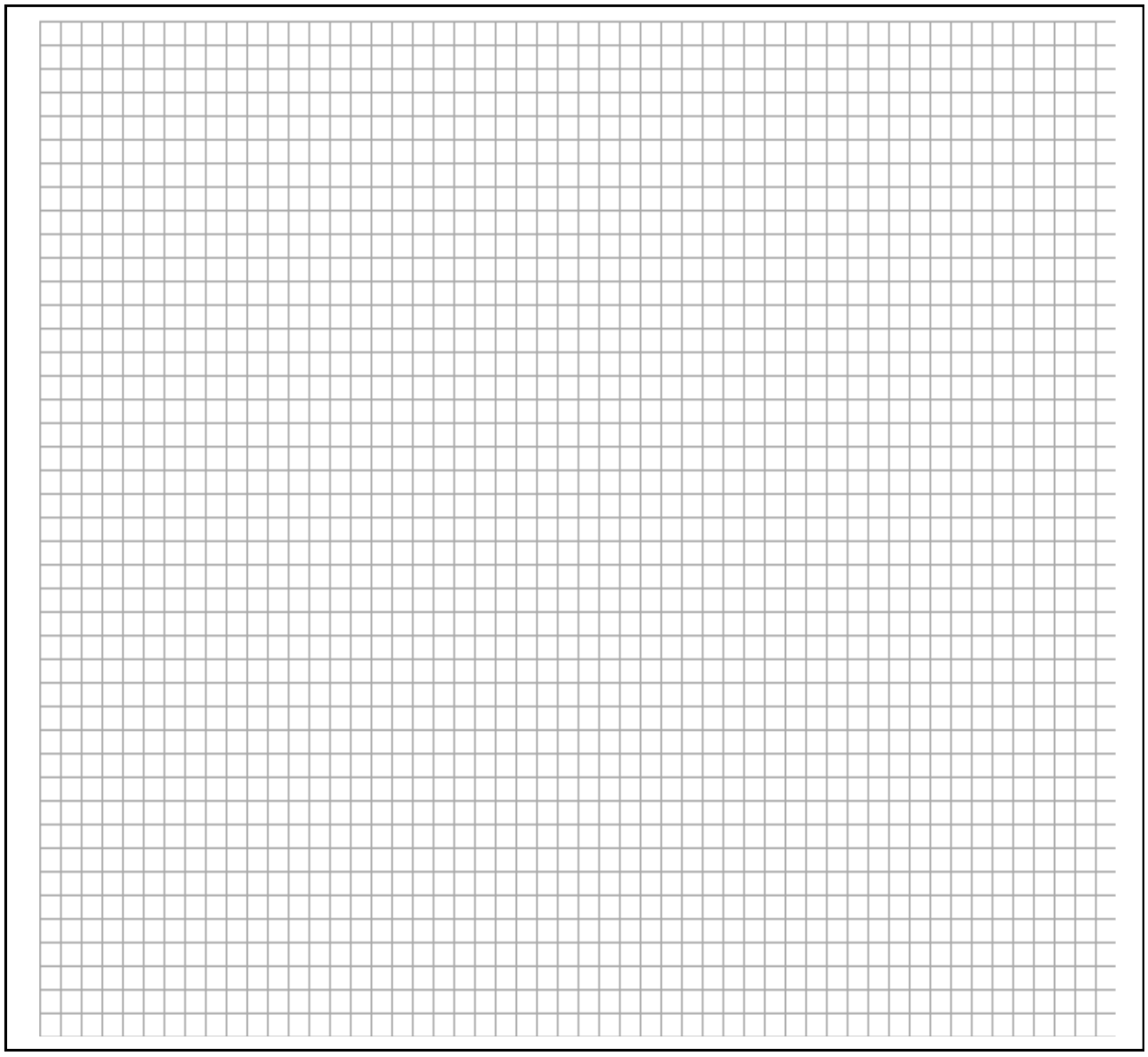
With Filter:

S.No	DC current Idc (mA)	DC Voltage Vdc (V)	AC voltage Vac (V)	Ripple factor = Vac / Vdc	% of regulation

7. Model Graph :



8. Graph



Observed Waveforms

9. Inference and Interpretation :

10. Scheme of Evaluation

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	Marks Awarded
1. Handling of apparatus	A.Identifying the various Components & selecting The correct range voltmeters And ammeter B. Setting the CRO C. Testing of transformer working condition	5	
2. Manipulation of apparatus	A. Drawing the circuit diagram B. Making the connections as per circuit. C. Connect the meters with correct polarities	15	
3.Precise operations /Activities	A. Measuring the no load voltage. B. Recording the readings in the Ammeter ,Voltmeters C. Calculating Ripple factor and percentage of regulation D. Observing the waveforms E. Drawing the Graph	25	
s	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	5	
		Total	50

Signature of the Staff

Signature of the Student

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

_____

4. Circuit Diagram:

5. Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	
9	

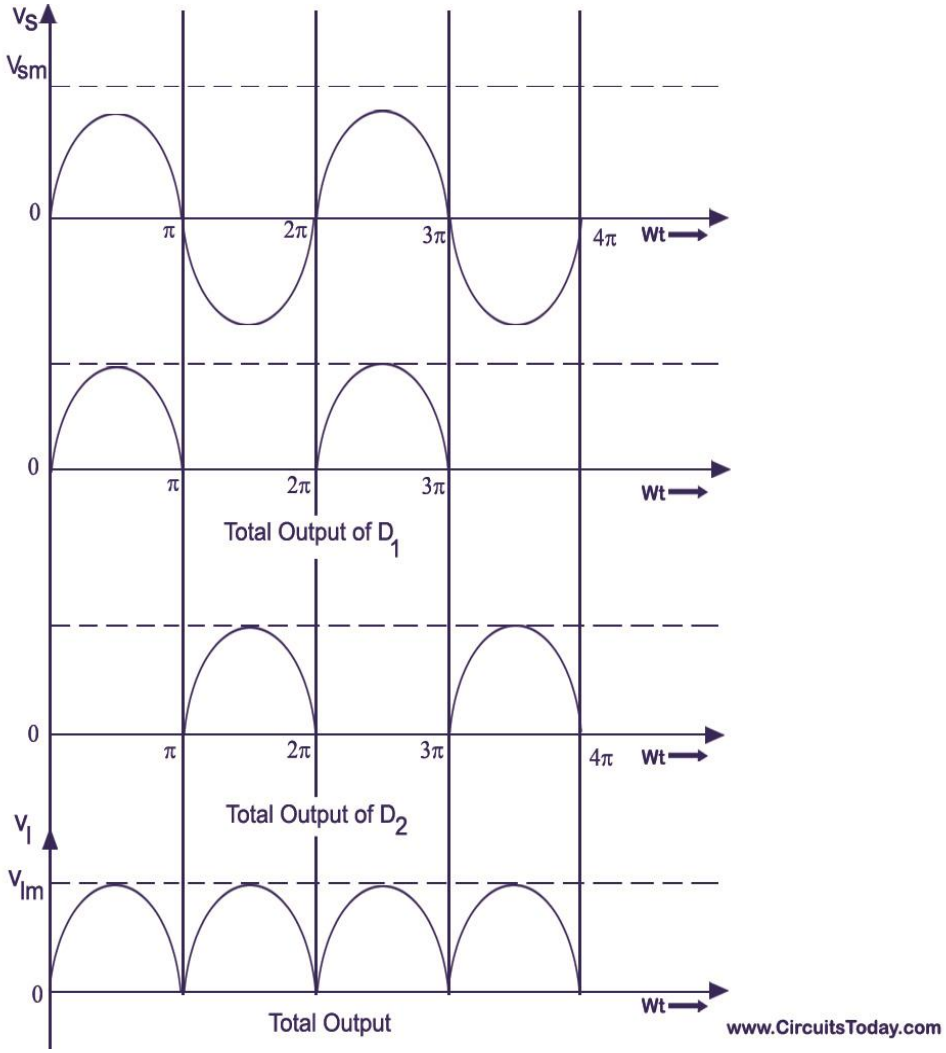
6. Readings: a) Without filter:

Sl No.	Load Resistance,R_L(KΩ)	I_{dc} (mA)	V_{dc}(Volts)	V_{rms}(Volts)	Ripple Factor	% of Regulation
01						
02						
03						
04						
05						

b) With filter

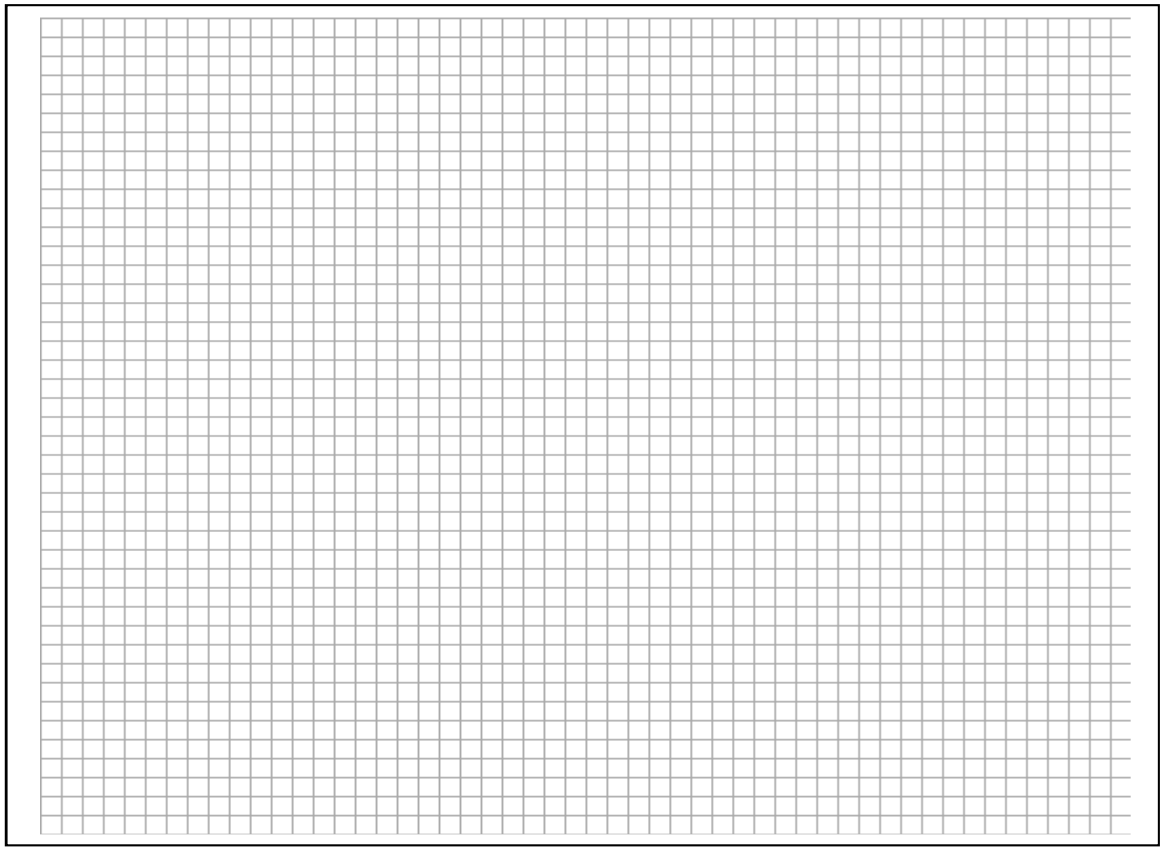
Sl No.	Load Resistance,R_L(KΩ)	I_{dc} (mA)	V_{dc}(Volts)	V_{rms}(Volts)	Ripple Factor	% of Regulation
01						
02						
03						
04						
05						

7. Model Graph: <u>a) Without Filter</u>



b) With Filter:

8. Graph:



Observed Waveforms

9. Inference and Interpretation:

10. Scheme of Evaluation:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
1. Handling of apparatus	A. Identification of Correct Components B. Identification of meters C. Identification of Transformer Terminals by marking	5	
2. Manipulation of apparatus	A. Making Circuit connections B. Adjusting the load resistance in the DRB C. Increasing the value of load resistance in steps of 1KΩ	15	
3. Precise operations /Activities	A. Recording the readings in the Ammeters, Voltmeter (or) Multimeter. B. Measuring the values of Idc, Vdc and Vac(with load and without Load). C. Calculate the Ripple factor and % of regulation. D. Observe the waveforms across the load resistance on CRO. E. Drawing the graph and to showing salient points	25	
4.Values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	5	
		Total	50

Signature of the Staff **Signature of the Student**

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

_____

4. Circuit Diagram:

5. Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	

6. Readings:

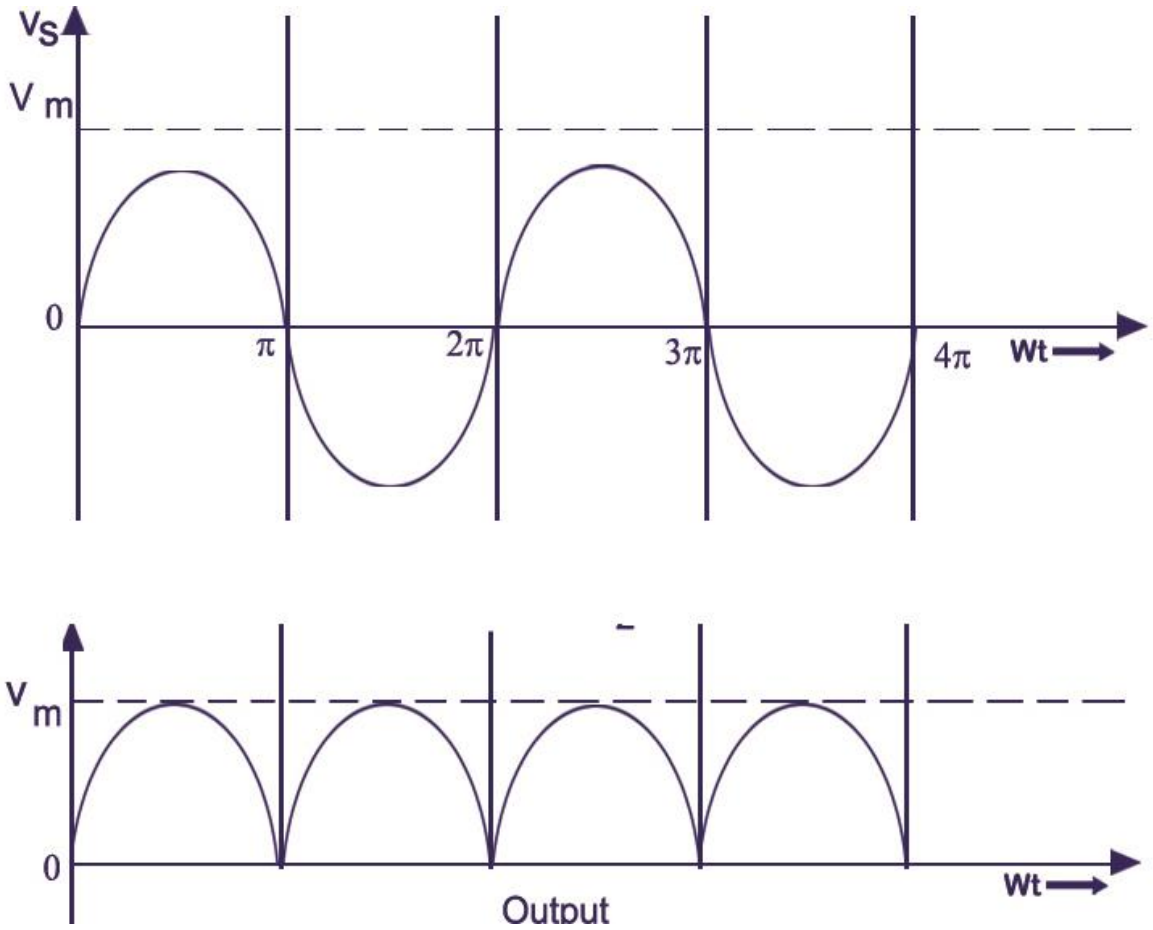
a) Without Filter

Sl No.	Load Resistance,RL(KΩ)	Vdc(Volts)	Vrms(Volts)	Ripple Factor	% of Regulation
01					
02					
03					
04					
05					

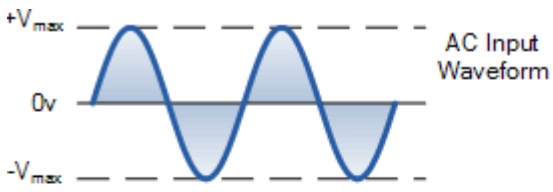
b) With Filter

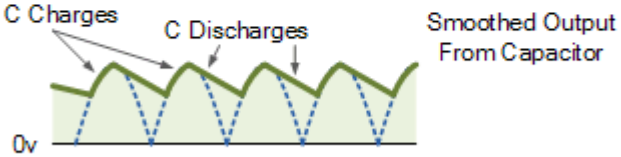
Sl No.	Load Resistance,RL(KΩ)	Vdc(Volts)	Vrms(Volts)	Ripple Factor	% of Regulation
01					
02					
03					
04					
05					

7. Model Graph:<u>a) Without Filter</u>

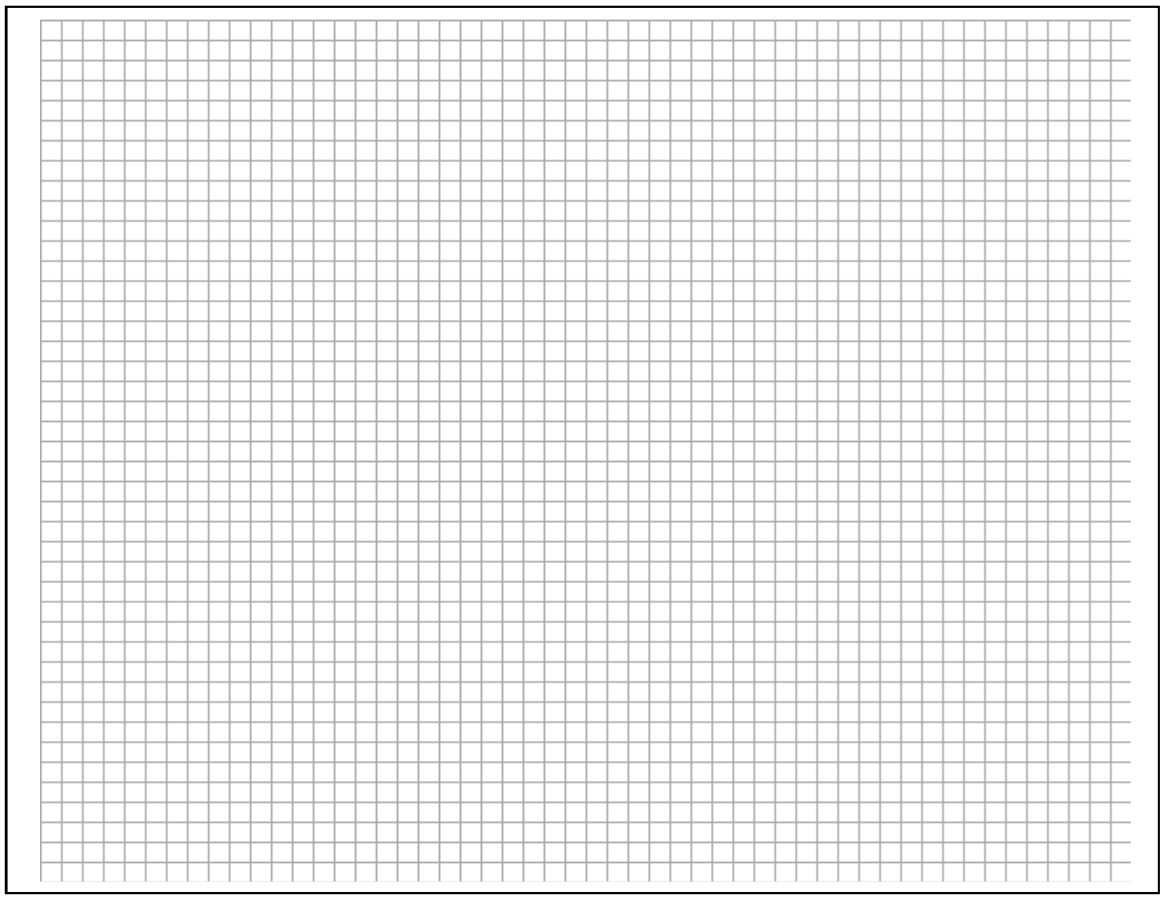


With filter





8. Graph:



Observed Waveforms

9.Inference and interpretation:

Scheme of Evaluation

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
1. Handling of apparatus	A) Identifying various terminals B) Using correct range Voltmeter, Ammeters. C) Setting the DRB to correct values. D) Identification of Transformer terminals by markings. E)Identification of capacitor and inductor values for filter circuits	5	
2. Manipulation of apparatus	A) Draw the Circuit Diagram. B) Making the connections as per the circuit diagram. C) Adjusting the load resistance in DRB D) Connect capacitor filter.	15	
3.Precise operations /Activities	**Without Filter** A) Measure Vdc (no Load) B) Increase the load resistance in steps of 1kΩ. C) Recording the values of Vdc, Vaconmultimeter. D) Observing the waveforms on CRO. E) Calculating the values of Ripple factor and % of regulation. **With Filter** F) Connect 1000µf capacitor as shown in circuit. G)Measure V_{dc} and V_{ac} Tabulate the readings and observe the waveforms on CRO H)Drawing the graphs	25	
4.Values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	5	
		Total	50

Signature of the Staff

Signature of the Student

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment:

2 .Objective of the Experiment

3 .Equipment Required:

4. Circuit Diagram

5. PROCEDURE:-

6. Readings <u>OBSERVATIONS:</u>-

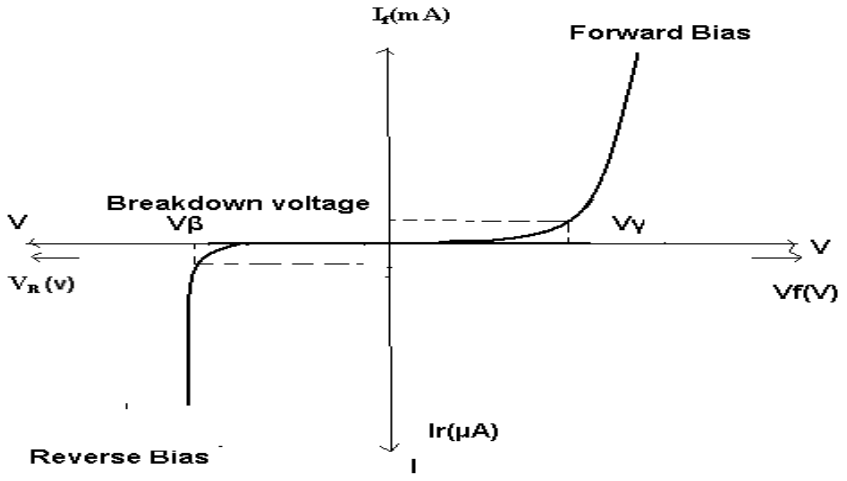
Static characteristics:-

S.NO	ZENER VOLTAGE(V_Z)	ZENER CURRENT(I_Z)

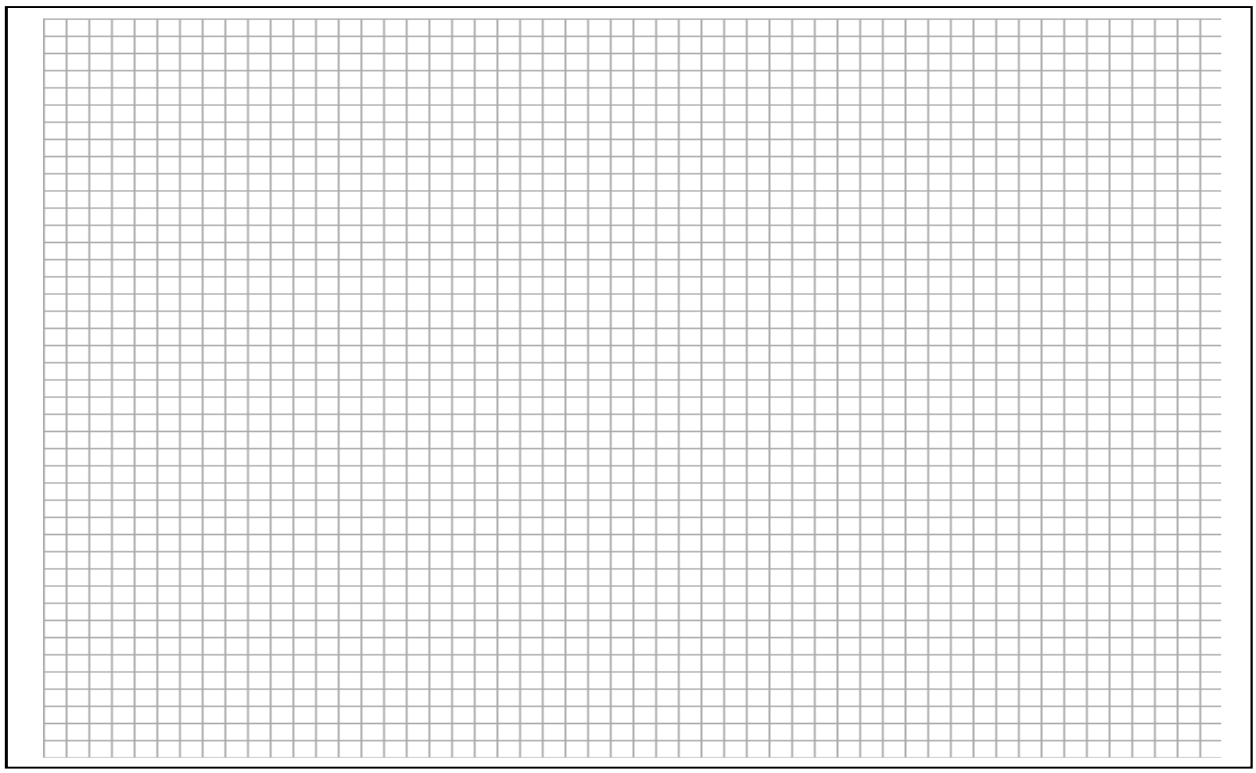
Regulation characteristics:-

S.N0	V_{NL}(VOLTS)	V_{FL} (VOLTS)	R_L (KΩ)	% REGULATION

7. Model Graph :



Observed Waveforms



8. Calculations

The percentage regulation is given by the formula

$((V_{NL}-V_{FL})/V_{FL})X100$

V_{NL}=Voltage across the diode, when no load is connected.

V_{FL}=Voltage across the diode, when load is connected

9. <u>Inferences and Interpretations</u>

10. Scheme of Evaluation:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	Marks Awarded
1. Handling of apparatus	A. Drawing circuit diagram and Identifying various terminals of ZENER Diode. B. Using correct range Voltmeter, Ammeter C. Connecting the ZENER DIODE in the circuit with correct polarity.	5	
2. Manipulation of apparatus	A. Varying the value of RPS B. Observing the readings in the Ammeter and Voltmeter	15	
3.Precise perations /Activities	A. Recording and observing the readings on voltmeter, Ammeter. B. Finding Breakdown voltage or output voltage. C. Calculating the REGULATION of the Zener Diode. D. Drawing the graphs.	25	
4.Values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	5	
		Total	50

Signature of the Staff Signature of the Student

3.5.a.IC REGULATOR **WORK SHEET-A**

NAME OF THE STUDENT :		DATE OF EXERCISE:
PIN:	BRANCH : ECE	
INSTITUTION:		EXERCISE NO:

IC REGULATOR

1. Title of the Exercise:_____

2.Objective of the Exercise:_____

_____

3.Apparatus required:_____

_____

_____

4.Circuit diagram:

5.Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	

6.Readings:

Table: 1 Line Regulation for 7805:

S.No.	Unregulated Power Supply V_{in}(V)	Regulated Output Voltage V_O(V)

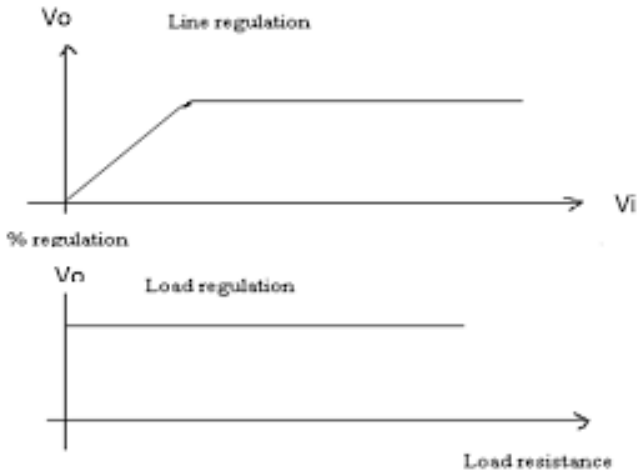
Table: 2 Load Regulation for 7805:

Input Supply Voltage V_{in} = _____ Volts

No-load DC Voltage, V_{NL} = _____ Volts

S.No.	Load Resistance R_L(K)	Unregulated Power Supply V_{in}(V	Regulated Output Voltage V_O (V)	% Voltage Regulation

7.Model waveform:



8.Graph :

9.Discussions on result:

10.Scheme of Evaluation:

Category of skill	Subtask	Weightage with competency level individually
Handling apparatus	a. Identification of Components and its terminals b. Setting the RPS to minimum volts position c. Identification of capacitor values d. Selecting proper wires and meters	5
Manipulations of apparatus	a) Draw the circuit diagram b) Using correct range meters. c) Make the connections as per the Circuit. d) Adjust the appropriate voltage level in Dual regulated power supply e) Adjust the RPS for different set of readings f) Draw regulation characteristics	15
Precise operations/activities	a) Measure the output voltage corresponding to input voltage. b) Record the values of output and input voltages c) Identify the point of saturation of output voltage	25
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5

SIGNATURE OF STAFF **SIGNATURE OF STUDENT**

3.5.a. IC REGULATOR **WORK SHEET-B**

NAME OF THE STUDENT :		**DATE OF EXERCISE:**
PIN:	**BRANCH : EEE**	
INSTITUTION:		**EXERCISE NO:**

IC REGULATOR

1. Title of the Exercise:_____

2.Objective of the Exercise:_____

_____

3.Apparatus required:_____

_____

_____

4.Circuit diagram:

5.Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	

6.Readings

Table: 1 Line Regulation for 7912:

S.No.	Unregulated Power Supply V_{in}(V)	Regulated Output Voltage V_O(V)

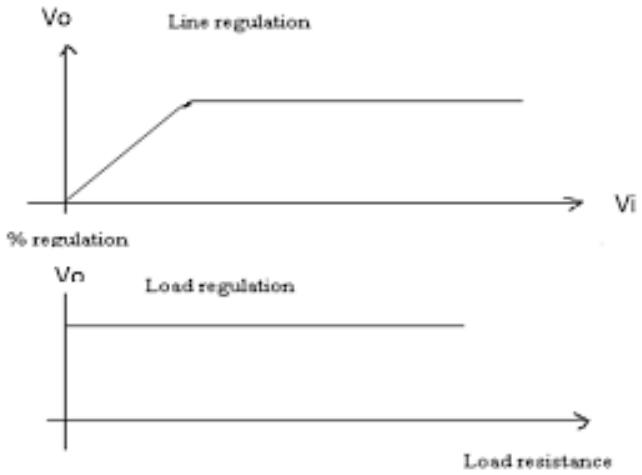
Table: 2 Load Regulation for 7912:

Input Supply Voltage V_{in} = _____ Volts

No-load DC Voltage, V_{NL} = _____ Volts

S.No.	Load Resistance R_L(K)	Unregulated Power Supply V_{in}(V	Regulated Output Voltage V_O (V)	% Voltage Regulation

7.Model waveform:



8.Graph :

9.Discussions on result:

10.Scheme of Evaluation:

Category of skill	Subtask	Weightage with competency level individually
Handling apparatus	a. Identification of Components and its terminals b. Setting the RPS to minimum volts position c. Identification of capacitor values d. Selecting proper wires and meters	5
Manipulations of apparatus	a) Draw the circuit diagram b) Using correct range meters. c) Make the connections as per the Circuit. d) Adjust the appropriate voltage level in Dual regulated power supply e) Adjust the RPS for different set of readings f) Draw regulation characteristics	15
Precise operations/activities	a) Measure the output voltage corresponding to input voltage. b) Record the values of output and input voltages c) Identify the point of saturation of output voltage	25
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5

SIGNATURE OF STAFF **SIGNATURE OF STUDENT**

3.5.a.IC REGULATOR **WORK SHEET-C**

NAME OF THE STUDENT :		**DATE OF EXERCISE:**
PIN:	**BRANCH : EEE**	
INSTITUTION:		**EXERCISE NO:**

IC REGULATOR

1. Title of the Exercise:_____

2.Objective of the Exercise:_____

_____

3.Apparatus required:_____

_____

_____

4.Circuit diagram:

5.Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	

6.Readings:

Table: 1 Line Regulation for LM317:

S.No.	Unregulated Power Supply V_{in}(V)	Regulated Output Voltage V_O(V)

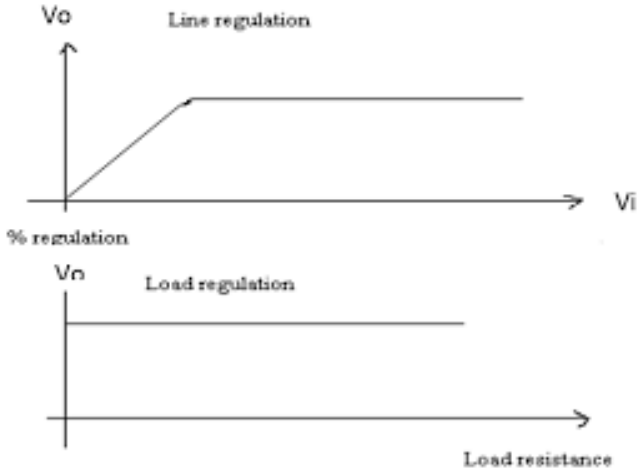
Table: 2 Load Regulation for LM317:

Input Supply Voltage V_{in} = _____ Volts

No-load DC Voltage, V_{NL} = _____ Volts

S.No.	Load Resistance R_L(K)	Unregulated Power Supply V_{in}(V	Regulated Output Voltage V_O (V)	% Voltage Regulation

7.Model waveform:



8.Graph :

9.Discussions on result:

10.Scheme of Evaluation:

Category of skill	Subtask	Weightage with competency level individually	MARKS AWARDED
Handling apparatus	a. Identification of Components and its terminals b. Setting the RPS to minimum volts position c. Identification of capacitor values d. Selecting proper wires and meters	5	
Manipulations of apparatus	a) Draw the circuit diagram b) Using correct range meters. c) Make the connections as per the Circuit. d) Adjust the appropriate voltage level in Dual regulated power supply e) Adjust the RPS for different set of readings f) Draw regulation characteristics	15	
Precise operations/activities	a) Measure the output voltage corresponding to input voltage. b) Record the values of output and input voltages c) Identify the point of saturation of output voltage	25	
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5	

SIGNATURE OF STAFF **SIGNATURE OF STUDENT**

3.6 REGULATED POWER SUPPLY USING 78XX/79XX **WORK SHEET**

REGULATED POWER SUPPLY USING 78XX/79XX

NAME OF THE STUDENT :		**DATE OF EXERCISE:**
PIN:	**BRANCH : DECE**	
INSTITUTION:		**EXERCISE NO:**

Student Details:

1. Title of the Exercise:_____

2.Objective of the Exercise:_____

_____

3.Apparatus required:_____

_____

_____

4.Circuit diagram:

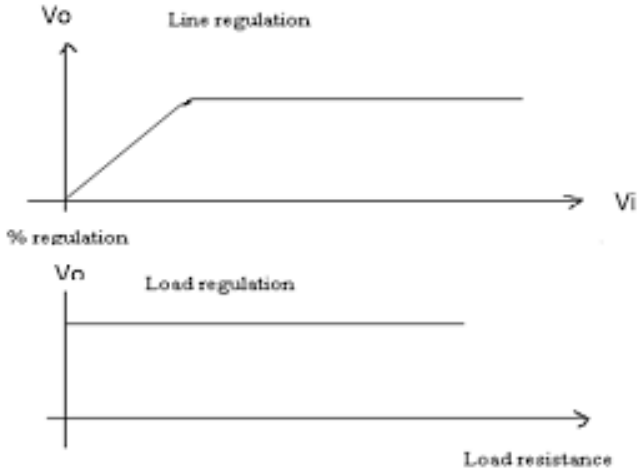
5.Procedure:

Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	

6.Readings:

Sl.no	Input voltage (V_{in})	Output voltage(V_{out})	% Regulation
1			
2			
3			
4			
5			
6			
7			
8			

7.Model waveform:



8.Graph :

9.Discussions on result:

10.Scheme of Evaluation:

Category of skill	Subtask	Weightage with competency level individually	MARKS AWARDED
Handling of apparatus	a) Identification of Components and its terminals b) Using correct range meters. c) Setting the RPS to minimum volts position d) Identification of capacitor values e) Selecting proper wires and meters	5	
Manipulations of apparatus	a) Draw the circuit diagram b) Make the connections as per the Circuit. c) Adjust the appropriate voltage level in Dual regulated power supply d) Adjust the RPS for different set of readings e) Draw regulation characteristics	15	
Precise operations/activities	a) Measure the output voltage corresponding to input voltage. b) Record the values of output and input voltages c) Identify the point of saturation of output voltage	25	
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5	

SIGNATURE OF THE STAFF **SIGNATURE OF THE STUDENT**

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment : _____

2. Objective of the Experiment : _____

3. Equipment Required : _____

_____

4. Circuit Diagram:

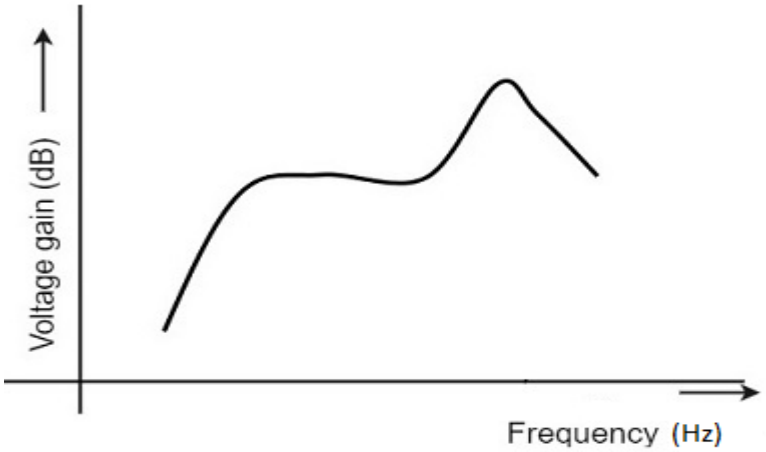
5. Procedure:

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

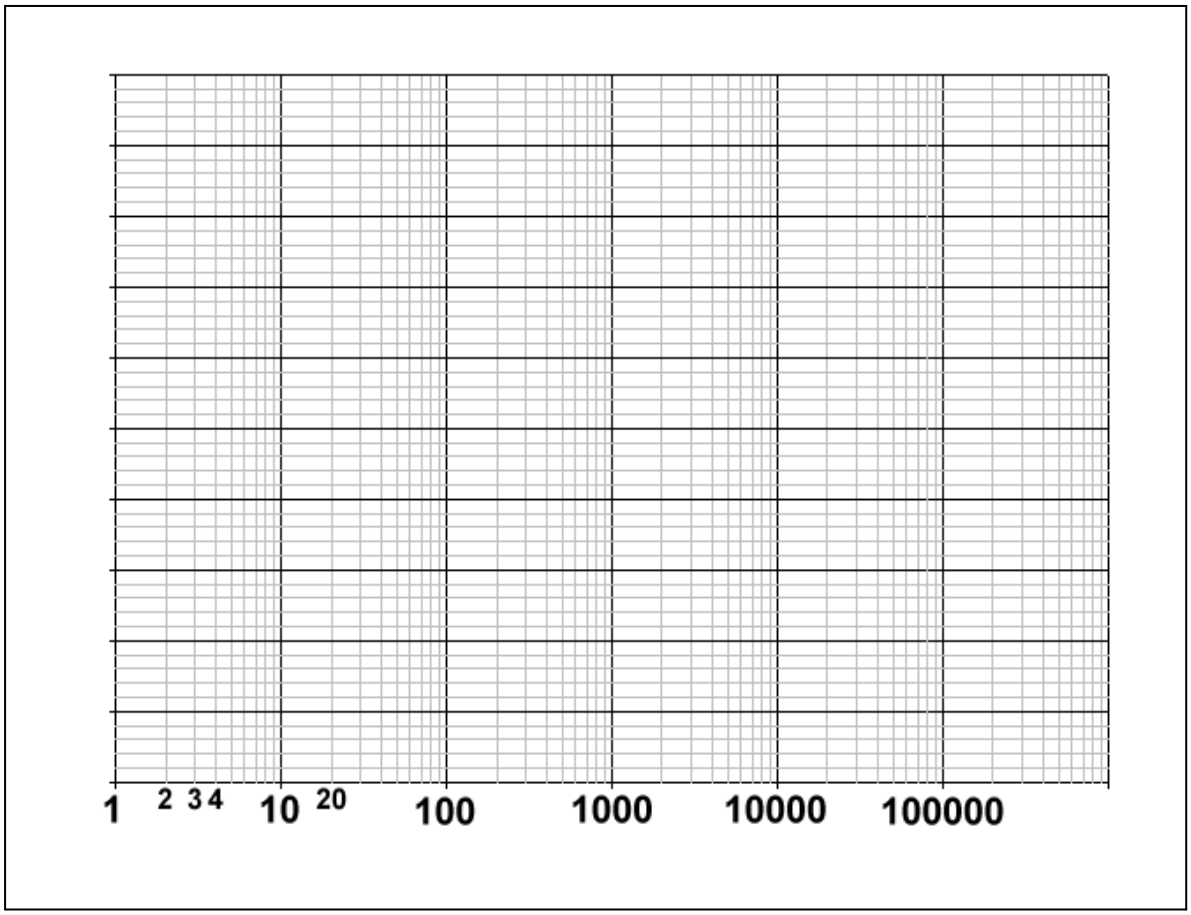
6. Readings :

S.No	Input frequency	Input Voltage (in Volts)	Output voltage (in Volts)	Gain $\frac{V_0}{V_{in}}$	Gain in Db $20 \log \frac{V_0}{V_{in}}$
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

7. Model Graph:



8. Graph:



Frequency (Hz)

9. Inference and Interpretation:

10. Scheme of Evaluation:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
1. Handling of apparatus	A. Identifying the equipment. B. Selecting correct components, meters and wires. C. Identification of Transformer terminals by markings. D. Identifying the transistor terminals.	8	
2.Manipulation of apparatus	A. Drawing the circuit diagram B. Making the connections. C. Following standard procedures (Correct colour code, polarity, tight connections etc.,) D. Selecting correct mode and range of signal generator, CRO, RPS and Multimeter. E. Observing the readings in CRO and Signal Generator.	12	
3.Precise operations/ Activities	A. Connecting Signal Generator, RPS and CRO probes to the correct terminals. B. By measuring the resistance values , identify the transistor terminals C. By measuring the resistance values , identify the transformer winding D. Record the input and output voltages at different frequencies from CRO E. Determine the Gain F. Plot the frequency response on Logarithmic Graph sheet G. Interpreting the response	25	
4.Values	A. Co Operation B. Co-Ordination C. Communication D. Sharing E. Leadership	5	
		Total	5

Signature of the Staff member

Signature of the Student

3.8 FREQUENCY RESPONSE OF A RC COUPLED AMPLIFIER WORK SHEET

PLOT THE FREQUENCY RESPONSE CHARACTERISTICS OF A RC COUPLED AMPLIFIER

NAME OF THE STUDENT :		DATE OF EXPERIMENT:
PIN:	BRANCH : ECE	
INSTITUTION:		EXPERIMENT NO:1

TITLE OF THE EXPERIMENT:

3.6.1. OBJECTIVE OF THE EXPERIMENT:

3.6.2 EQUIPMENT REQUIRED:

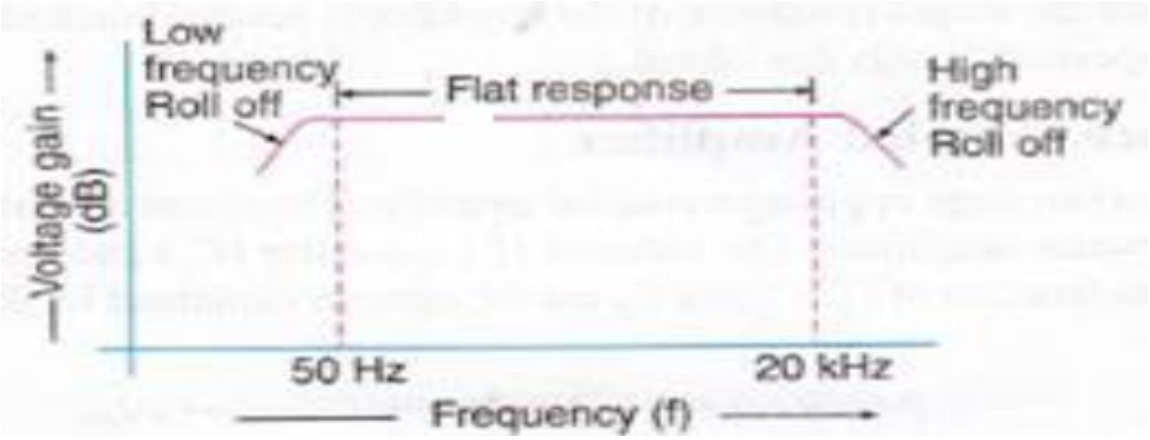
3.6.3 CIRCUIT DIAGRAM:

3.6.4 PROCEDURE:

3.6.5. READINGS:

s.no	Frequency(f) Hz	Output voltage(Vo)	Vo/vi	20 log Vo/Vi
1				
2				
3				
4				
5				
6				
7				

3.6.6. MODEL GRAPH:



3.6.7. CALCUATIONS

1. Gain = $20\log(V_0/V_i)$

2.Bandwidth = f_h-f_l

3.6.8 RESULT: The frequency response of the R-C coupled amplifier is obtained.

3.6.9 Discussions on result:

3.6.10 Scheme of evaluation:

Category of skill	Subtask	Weightage with competency level individually	Marks Awarded
Handling apparatus	a) Identifying different solid state devices b) Identification of test points in circuit. c) Identifying different components	5	
Manipulations of apparatus	a) Designing Circuit b) Choosing proper values of resistor, regulated power supply. c) Identifying proper terminals of transistor. d) Proper connections as per the circuit	20	
Precise operations/Activities	a) Identifying breakdown voltages from data sheet. b) Identifying cut off , saturation and active regions of BC107 transistor. c) Plot the frequency response on semi log sheet. d) Calculate the gain and bandwidth	20	
Values	a) Co-operation b) Co-ordination c) Communication d) Attitude e) leadership	5	

SIGNATURE OF THE STAFF **SIGNATURE OF THE STUDENT**

COLPITTS OSCILLATOR

NAME OF THE STUDENT :		DATE OF EXPERIMENT:
PIN:	BRANCH : ECE	
INSTITUTION:		EXPERIMENT NO:

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

_____

4. Circuit Diagram:

5.Procedure:

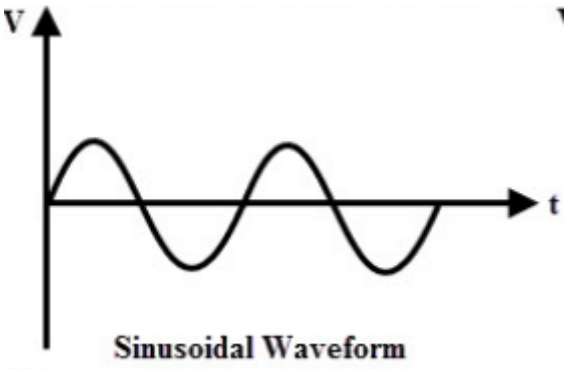
Sl No.	Procedure
1	
2	
3	
4	
5	
6	
7	
8	
9	

6.Readings:

Output waveform:

S.NO	C_1 (farads)	C_2 (farads)	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1					
2					
3					
4					

7.Model Waveform:



Sinusoidal Waveform

8. Graph:

8.Calculations:

Theoretical frequency (f_0)= $1/(2\Pi(LC_T)^{1/2})$

Where $C_T = (C_1 \times C_2)/(C_1+C_2)$.

Practical frequency (f_0)=(1/T)

Where Time Period (T) = No. of horizontal divisions x Times/division

Amplitude= No. of vertical divisions x volts/division=

9. Inference and Interpretation:

10.Scheme of evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	a. Drawing the circuit diagram b. Identification of Components c. Identification of terminals of the transistor d. Identifying major sections (amplifier & Feedback section) e. Identification of test points in circuit.	5	
Manipulations of apparatus	a. Make the connections as per the Circuit. b. Check the proper function of the CRO c. Adjust the appropriate voltage level in Dual regulated power supply d. Observe the output waveform on CRO at the test point in the circuit.	15	
Precise operations/activities	a) Adjust the capacitance and inductance of the tank circuit to get the sustained oscillations b) Note down the time period and amplitude of the output waveform c) Plotting output waveform on graph sheet d) Calculate the frequency of oscillations from the output waveform e) Verify the theoretical and practical frequencies.	25	
Values	• Co-operation • Co-ordination • Communication • Sharing • Leadership	5	
		TOTAL	50

SIGNATURE OF STAFF **SIGNATURE OF STUDENT**

HARTLEY OSCILLATOR

1. Student Details:

NAME OF THE STUDENT :		DATE OF EXPERIMENT:
PIN:	BRANCH : ECE	
INSTITUTION:		EXPERIMENT NO:

Title of the Experiment: HARTLEY OSCILLATOR

2.OBJECTIVE OF THE EXPERIMENT:

3. APPARATUS REQUIRED:

4. CIRCUIT DIAGRAM:

5. PROCEDURE:

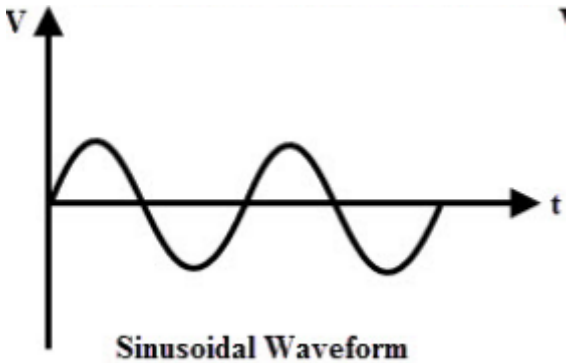
1.

6. READINGS:

Output waveform:

S.NO	L_1 (henrys)	L_2 (henrys)	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1					
2					
3					
4					

7. MODEL WAVEFORM:



Sinusoidal Waveform

8. CALCULATIONS:

Theoretical frequency (f_0)= $1/(2\Pi(L_T C)^{1/2})$

Where $L_T = L_1 + L_2$.

Practical frequency (f0**)=(1/T)**

Where Time Period (T) = No. of horizontal divisions x Times/division

Amplitude= No. of vertical divisions x volts/division=

9. Discussions on result:

10. Scheme of evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling apparatus	a. Drawing the circuit diagram b. Identification of Components c. Identification of terminals of the transistor d. Identifying major sections (amplifier & Feedback section) e. Identification of test points in circuit.	5	
Manipulations of apparatus	a. Make the connections as per the Circuit. b. Check the proper function of the CRO c. Adjust the appropriate voltage level in Dual regulated power supply d. Observe the output waveform on CRO at the test point in the circuit.	15	
Precise operations/activities	a) Adjust the inductance and capacitance of the tank circuit to get the sustained oscillations b) Note down the time period and amplitude of the output waveform c) Plotting output waveform on graph sheet d) Calculate the frequency of oscillations from the output waveform e) Verify the theoretical and practical frequencies.	25	
Values	a. Co-operation b. Co-ordination c. Communication d. Sharing e. Leadership	5	
		TOTAL	50

SIGNATURE OF STAFF **SIGNATURE OF STUDENT**

CRYSTAL OSCILLATOR

1. Student Details:

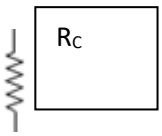
NAME OF THE STUDENT :		DATE OF EXPERIMENT:
PIN:	BRANCH : ECE	
INSTITUTION:		EXPERIMENT NO:

Title of the Experiment:

2. OBJECTIVE OF THE EXPERIMENT :

3. APPARATUS REQUIRED:

4. CIRCUIT DIAGRAM:



5. PROCEDURE:

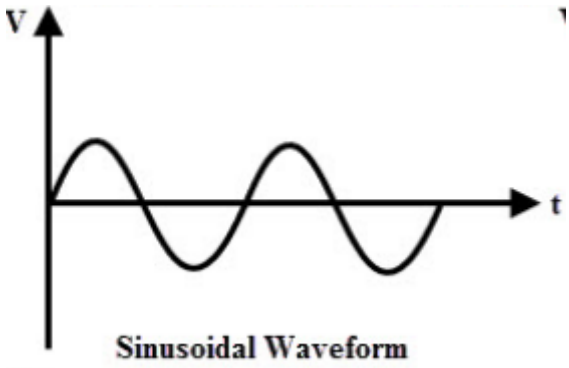
1.

6.READINGS:

Output waveform**:**

S.NO	crystal	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1				
2				
3				
4				

7. MODEL WAVEFORM:



Sinusoidal Waveform

8.CALCULATIONS:

Theoretical frequency (f_0)

$$f_s = \frac{1}{2\pi\sqrt{L_s C_s}} \quad f_p = \frac{1}{2\pi\sqrt{L_S \frac{C_P C_S}{C_P + C_S}}}$$

Practical frequency (f_0)=(1/T)

Where Time Period (T) = No. of horizontal divisions x Times/division

Amplitude= No. of vertical divisions x volts/division=

9.Discussions on result:

10.Scheme of evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	MARKS AWARDED
Handling of apparatus	a. Drawing the circuit diagram b. Identification of Components c. Identification of terminals of the transistor d. Identifying major sections (amplifier & Feedback section) e. Identification of test points in circuit.	5	
Manipulations of apparatus	a. Make the connections as per the Circuit. b. Check the proper function of the CRO c. Adjust the appropriate voltage level in Dual regulated power supply d. Observe the output waveform on CRO at the test point in the circuit.	15	
Precise operations/activities	a) Adjust the Crystal and capacitance of the tank circuit to get the sustained oscillations b) Note down the time period and amplitude of the output waveform c) Plotting output waveform on graph sheet d) Calculate the frequency of oscillations from the output waveform e) Verify the theoretical and practical frequencies.	25	
Values	a. Co-operation b.Co-ordination c. Communication d.Sharing e.Leadership	5	
		TOTAL	50

SIGNATURE OF STAFF **SIGNATURE OF STUDENT**

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.10

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

_____

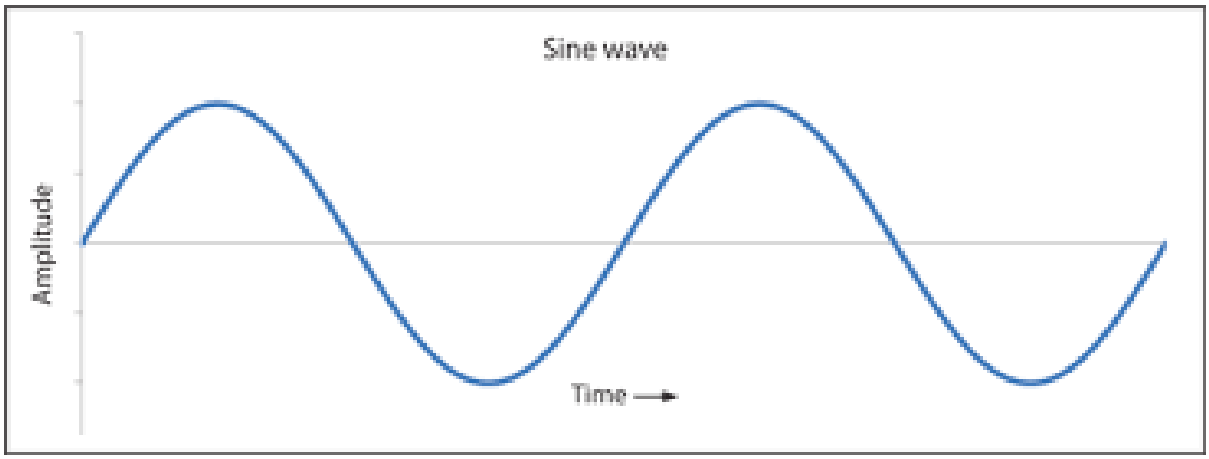
4. CircuitDiagram:

5. Procedure:

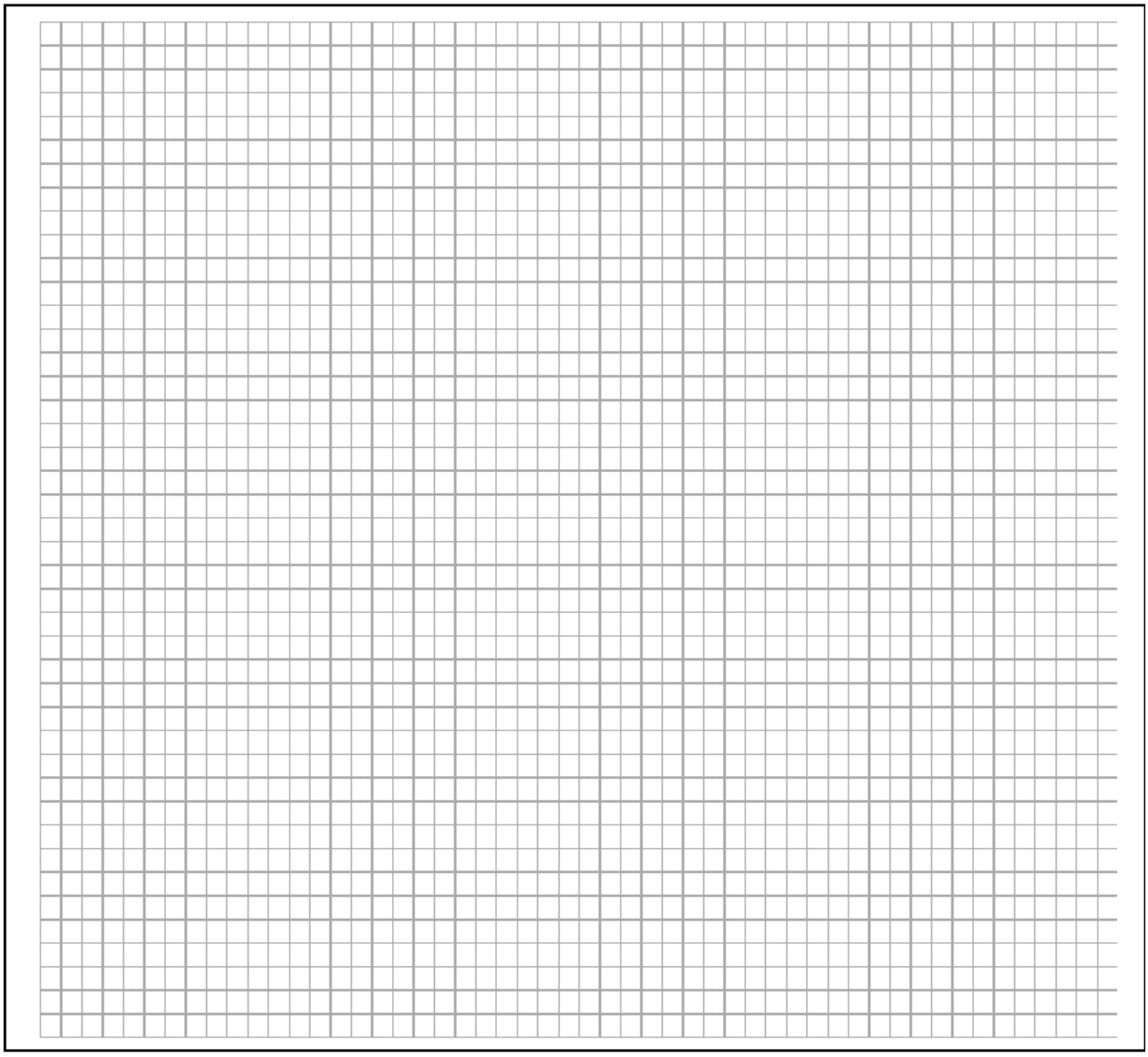
6. Readings:

S.No	Resistance value	Capacitance value	Amplitude	Time period	Frequency

7. Model Graph:



8. Graph:



Observed Waveform

9. Inference and Interpretation

10.Scheme ofEvaluation:

CATEGORY OF SKILL	SUB TASK	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	Marks Awarded
1. Handling of apparatus	A. Drawing the circuit diagram B. Identifying various components and terminals. C. Proper handling of CRO to get exact waveforms	5	
2. Manipulation of apparatus	A. Reading the Circuit Diagram. B. Making the connections as per circuit diagram. C. Checking the connections D. Connecting the CRO probes to correct terminals E. Adjusting the CRO and variable resistor to get exact waveforms	15	
3.Precise Operations /Activities	A. Measuring the amplitude and timeperiod of the output waveform B. Calculating the frequency of the output waveform C. Tabulating amplitude and timeperiod for different R,C values . D. Drawing the ouput waveform on the graph sheet	25	
Values	a) Co-operation b) Co-ordination c) Communication d) Attitude e) Leadership	**5**	
SIGNATURE OF STAFF		**SIGNATURE OF STUDENT**	

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment : _____

2. Objective of the Experiment : _____

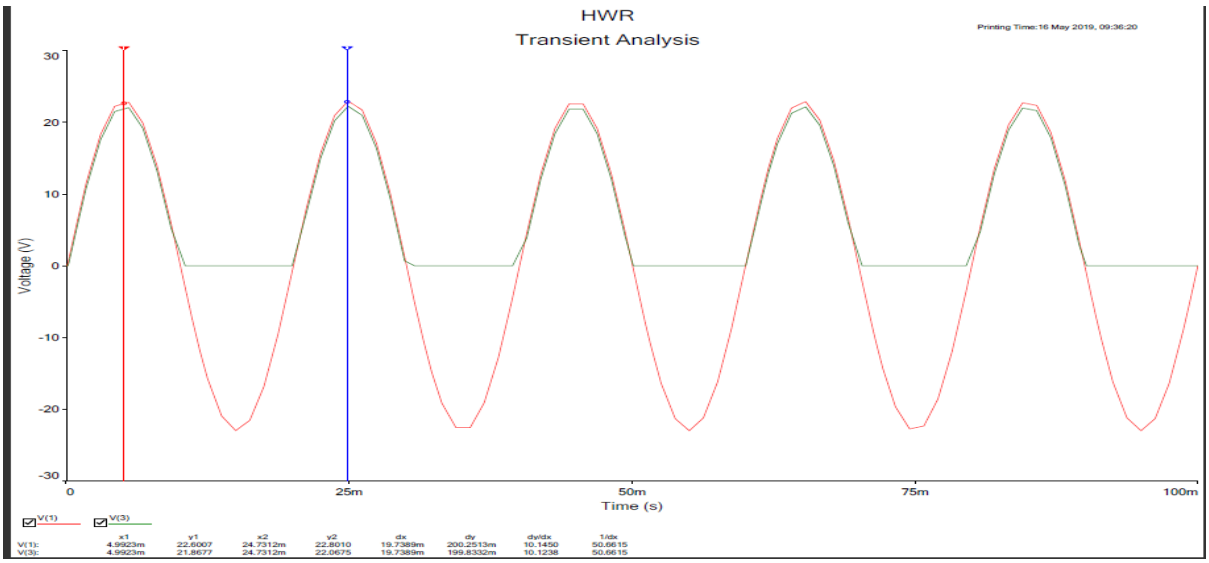
3. Equipment Required : _____

_____

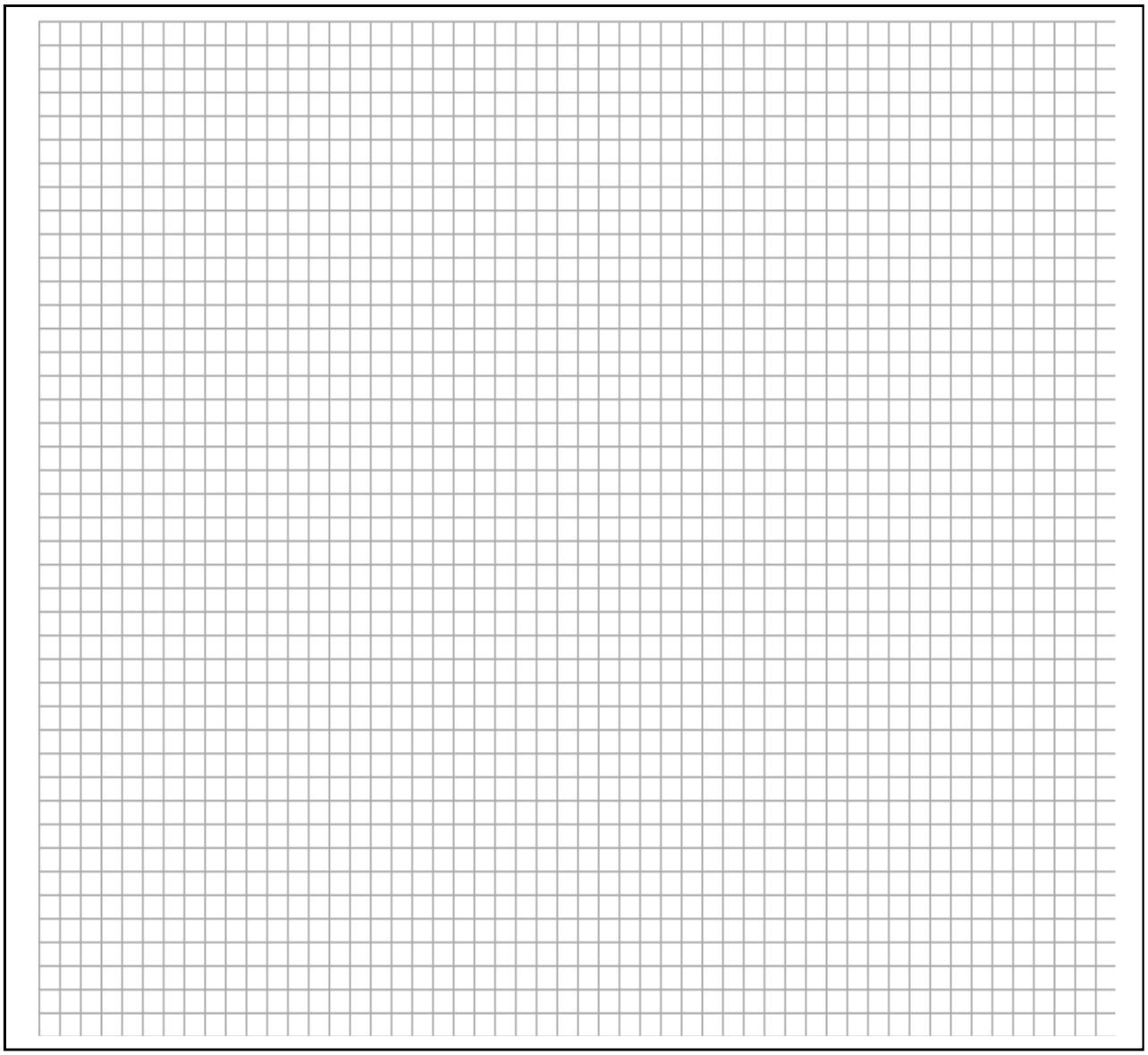
4. Circuit Diagram:

5. Procedure:

6. Model Graph:



7.Graph:



Observed Waveforms

8. Inference and Interpretation:

.

9. Scheme of Evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software'sPC simulationsoftwares B)Identifying major sections C) Identification of test points in circuit	5
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	1 5
Simulation and result analysis	A. Run the simulation and rectify the errors if any by modifying the connections B. Measuring the no load voltage. C.Recording the readings in the Ammeter,Voltmeters D.Calculating Ripple factor and percentage of regulation E.Observing the waveforms F. Drawing the Graph	25
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	5
	TOTAL	50

FULL WAVE RECTIFIER SIMULATION

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment : _____

2. Objective of the Experiment : _____

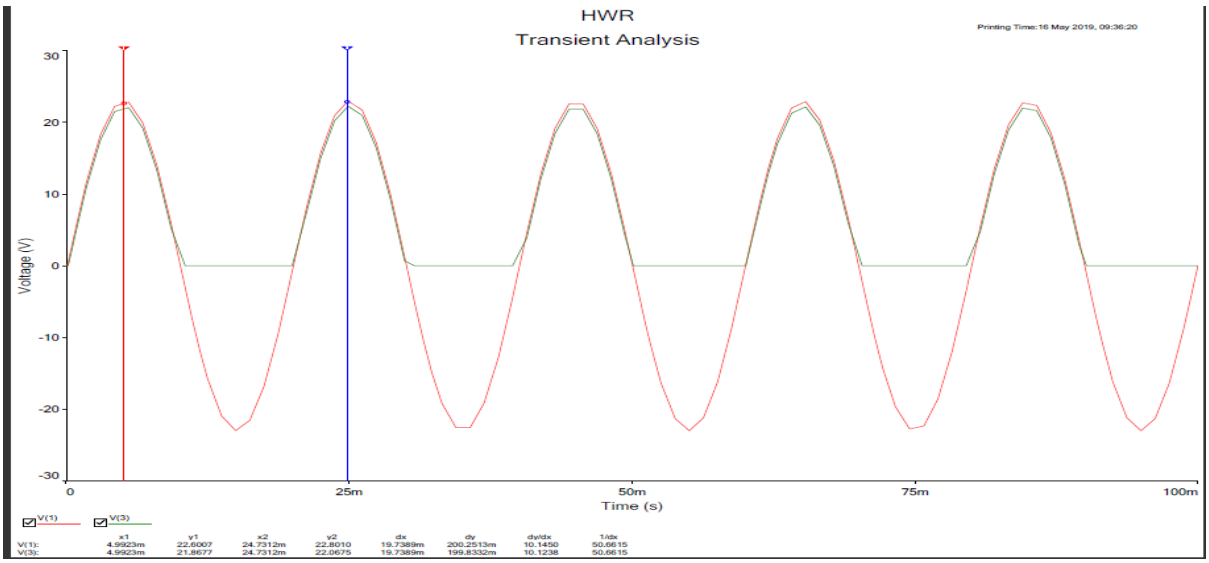
3. Equipment Required : _____

_____

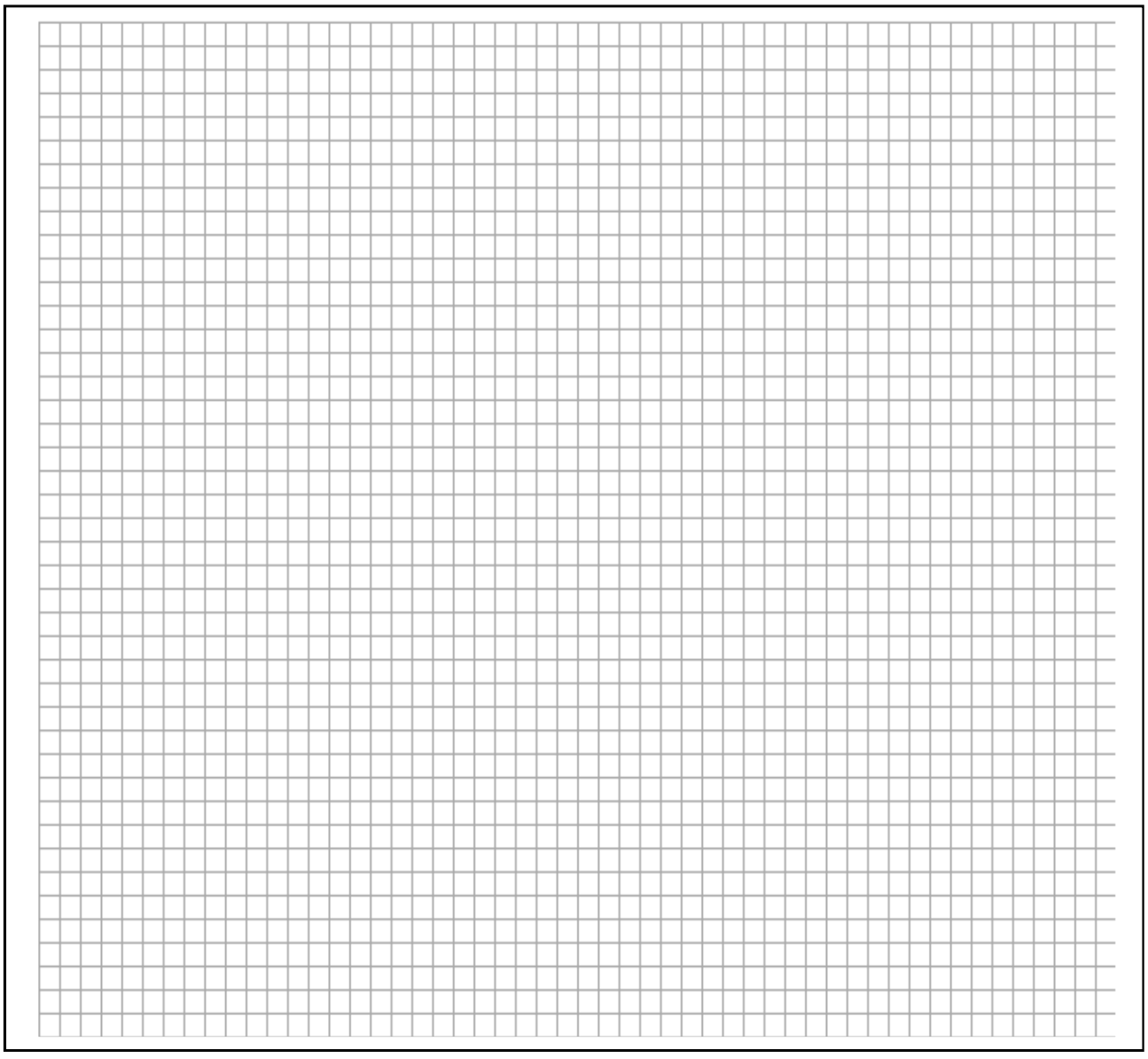
4. Circuit Diagram:

5. Procedure:

6. Model Graph:



7.Graph:



Observed Waveforms

8. Inference and Interpretation:

9. Scheme of Evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B)Identifying major sections C) Identification of test points in circuit	5
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	15
Simulation and result analysis	A. Run the simulation and rectiify the errors if any by modifying the connections B. Measuring the no load voltage. C.Recording the readings in the Ammeter ,Voltmeters D.Calculating Ripple factor and percentage of regulation E.Observing the waveforms F. Drawing the Graph	25
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	5
	TOTAL	50

3.14. ZENER REGULATOR **WORK SHEET**

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

_____

4. Circuit Diagram:

5. Procedure:

A. Line regulation:

SL NO	PROCEDURE

B. Load regulation:

SL NO	PROCEDURE

6. Readings:

Zener breakdown voltage Vz = in volts.

Line characteristics:-

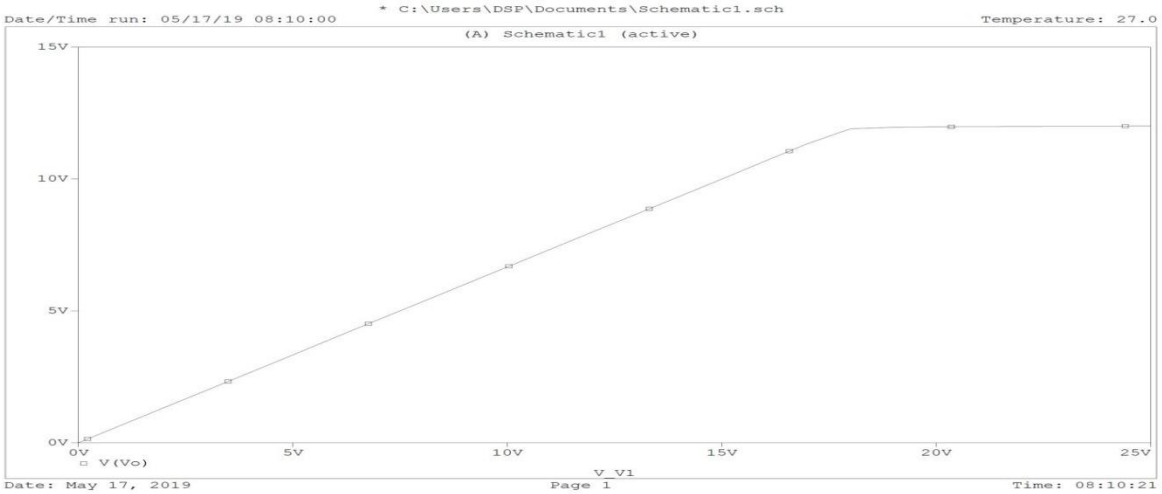
S.NO	ZENER VOLTAGE(V_Z)	ZENER CURRENT(I_Z)

Load characteristics:-

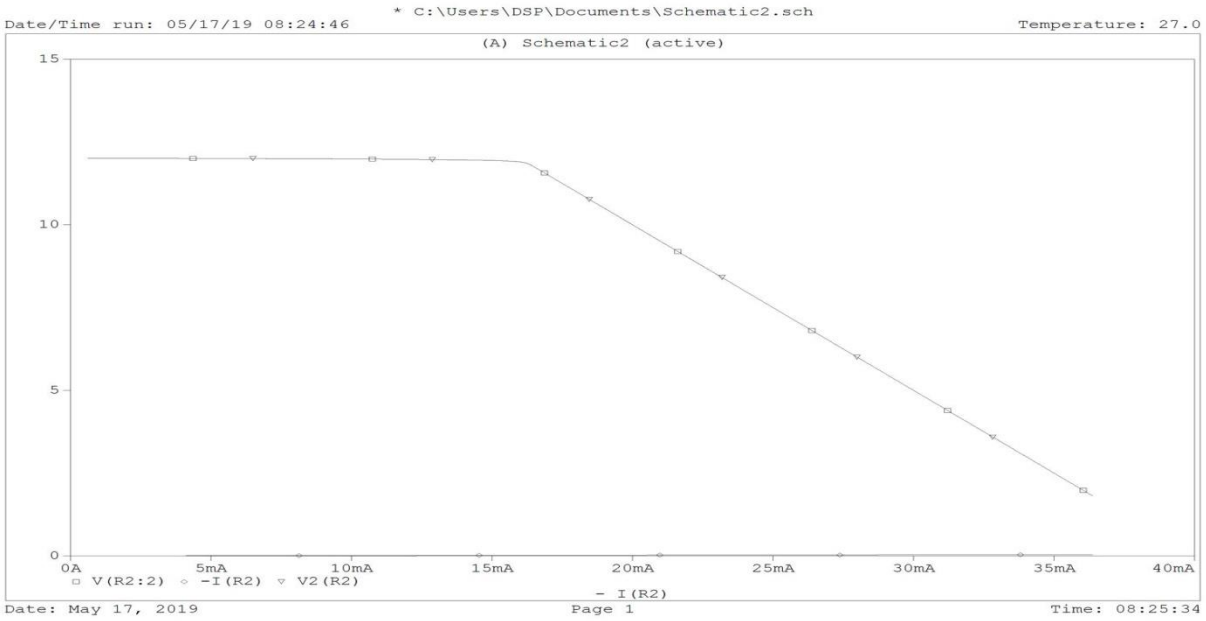
S.N0	V_{NL}(VOLTS)	V_{FL} (VOLTS)	R_L (KΩ)	% REGULATION

7. Model Graph:

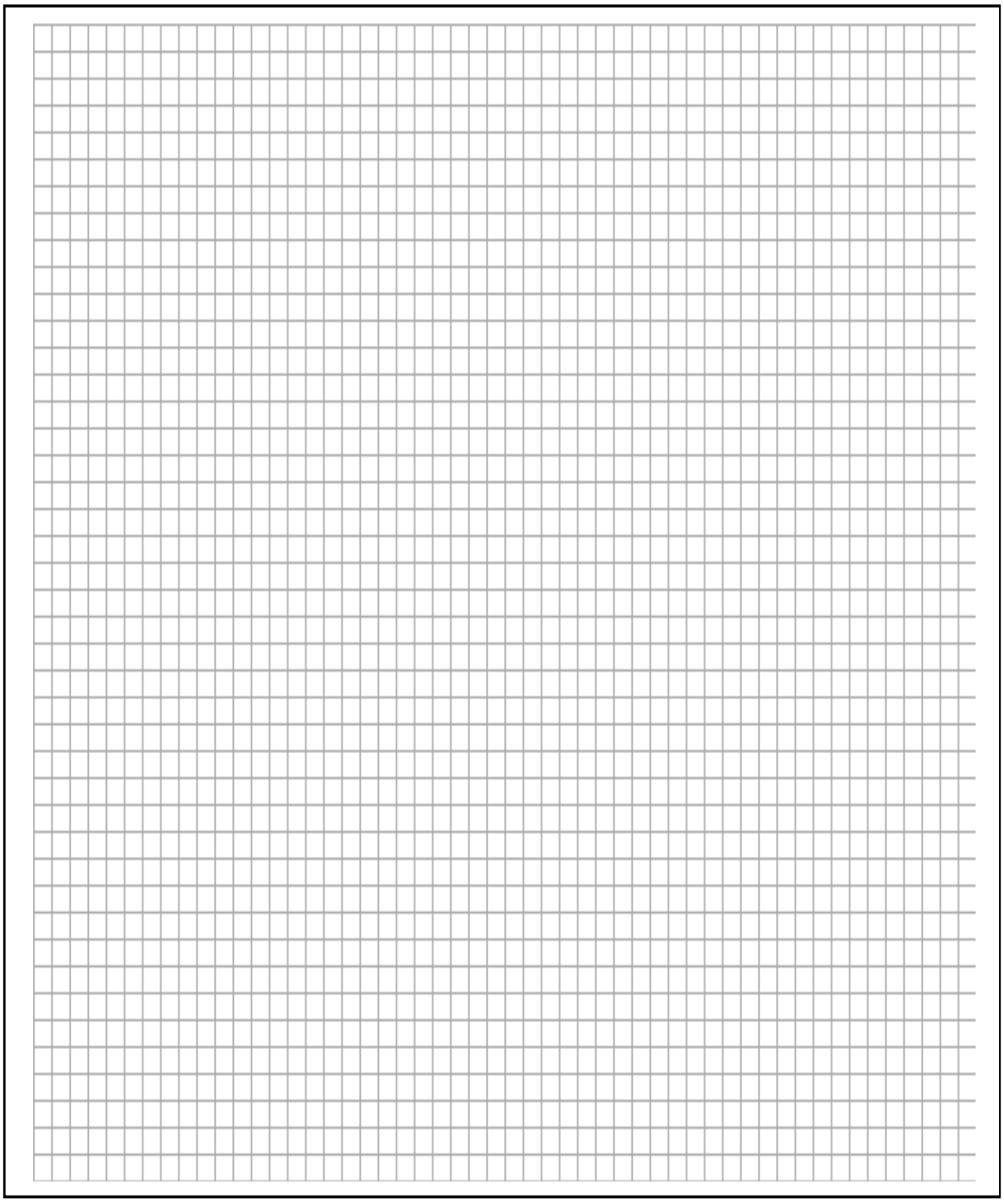
Line Regulation



Load Regulation



8. Graph:



10. Scheme of Evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulation softwares B)Identifying major sections (amplifie & Feedback section) C) Identification of test points in circu	5
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	15
Simulation and result analysis	A. Run the simulation and rectify the errors if any by modifying the connections B. Adjusting the RPS to minimum position and maximum position as to get the required voltage. C. Recording and observing the readings on voltmeter, Ammeter. D. Finding Breakdown voltage or output voltage. E. Calculating the regulation of the Zener Diode. F. Drawing the graphs	25
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	5

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

_____

4. Circuit Diagram:

5. Procedure:

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

6. Readings:

Input wave:

Amplitude:

Time period:

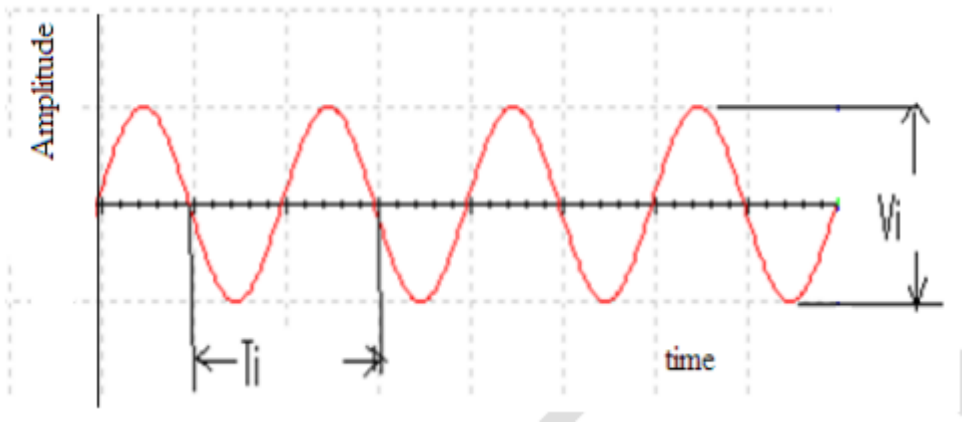
Frequency:

Output wave:

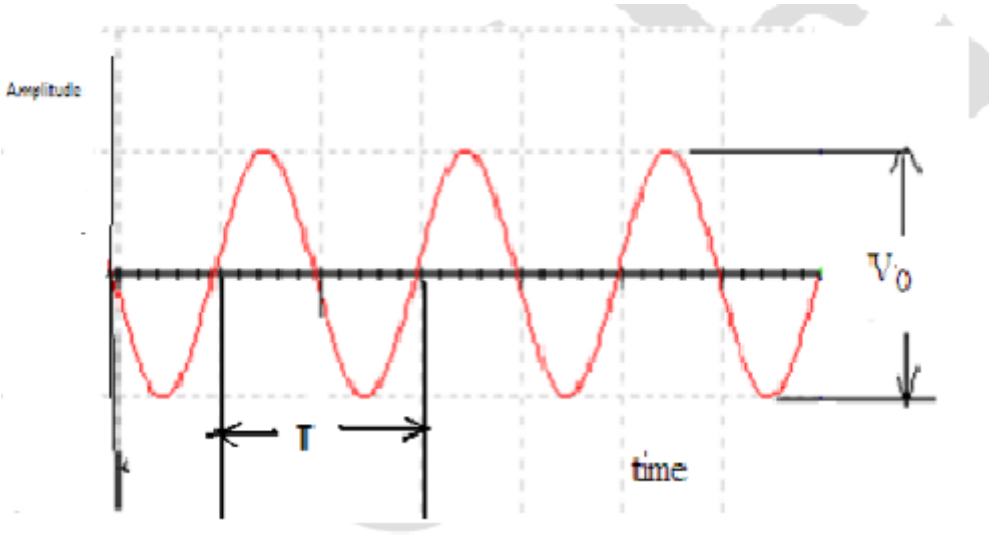
	With bypass	without bypass
Amplitude		
Time period:		
Frequency		

7. Model Graph:

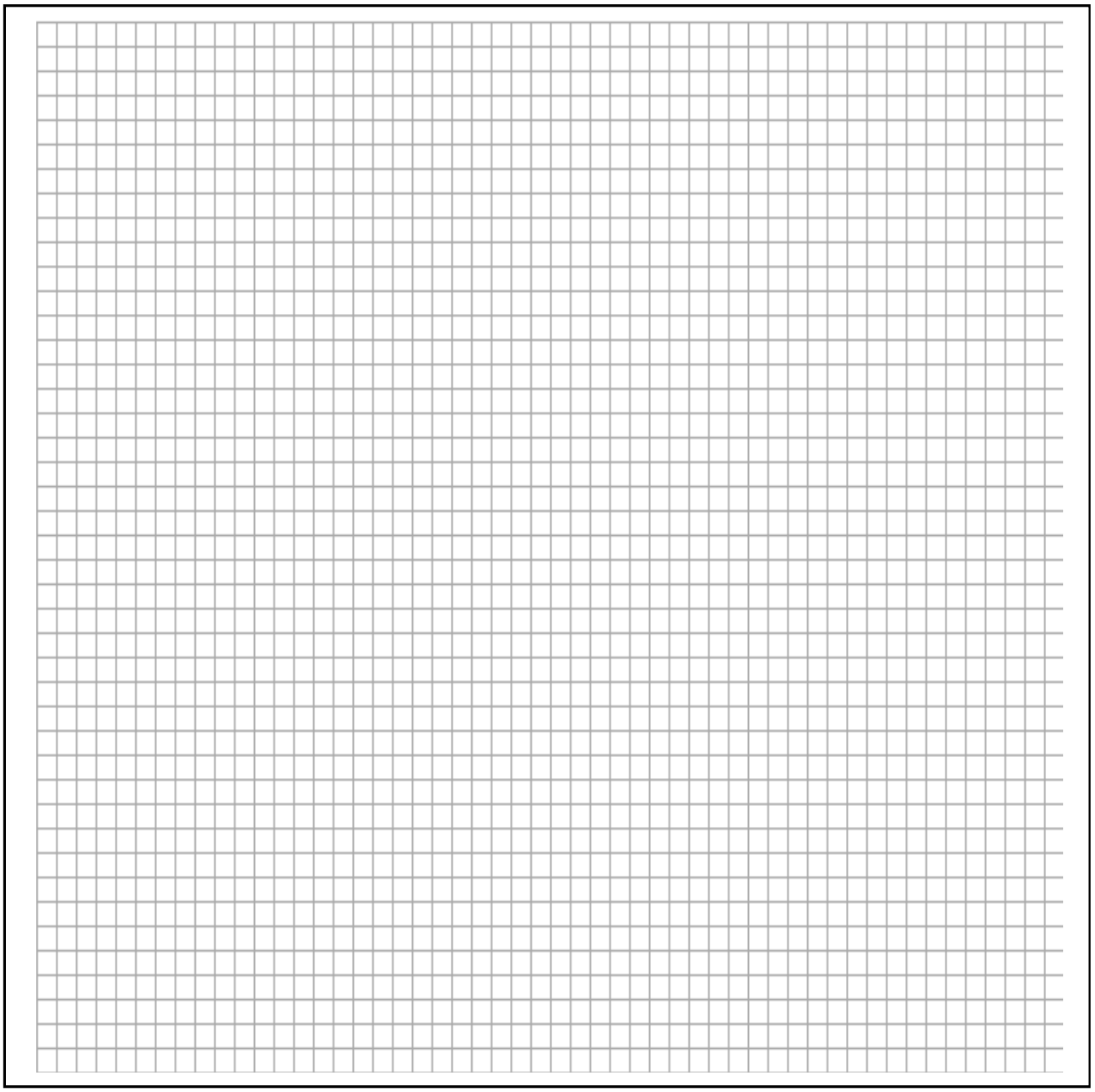
Inputwaveform:



Outputwaveform:



8. Graph:



Observed Waveforms

9. Inference and Interpretation:

10. Scheme of Evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY
Familiarization of PSPICE software/Multisim	A. A) Working with Desktop PC simulation software's PC simulation softwares B. B)Identifying major sections (amplifier) C. C) Identification of test points in circuit	5
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B. Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	15
Simulation and result analysis	A. Run the simulation and rectify the errors if any by modifying the connections B. Note down the time period and Amplitudeof the output Waveform with capacitor C. Plotting output waveform on graph sheet D. Note down the time period and amplitude of the output Waveform with out capacitor E. Plotting output waveform on graph sheet F. Note down the time period and amplitude of the output Waveform with capacitor	25
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	5
	TOTAL	

SIGNATURE OF STAFF SIGNATURE OF STUDENT

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

_____

4. Circuit Diagram:

5. Procedure:

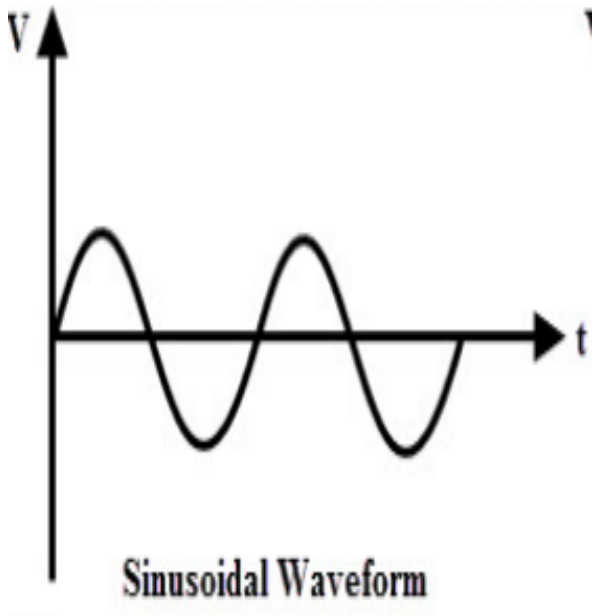
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

6. Readings:

S.NO	C (µF)	R (ohms)	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1					
2					
3					
4					

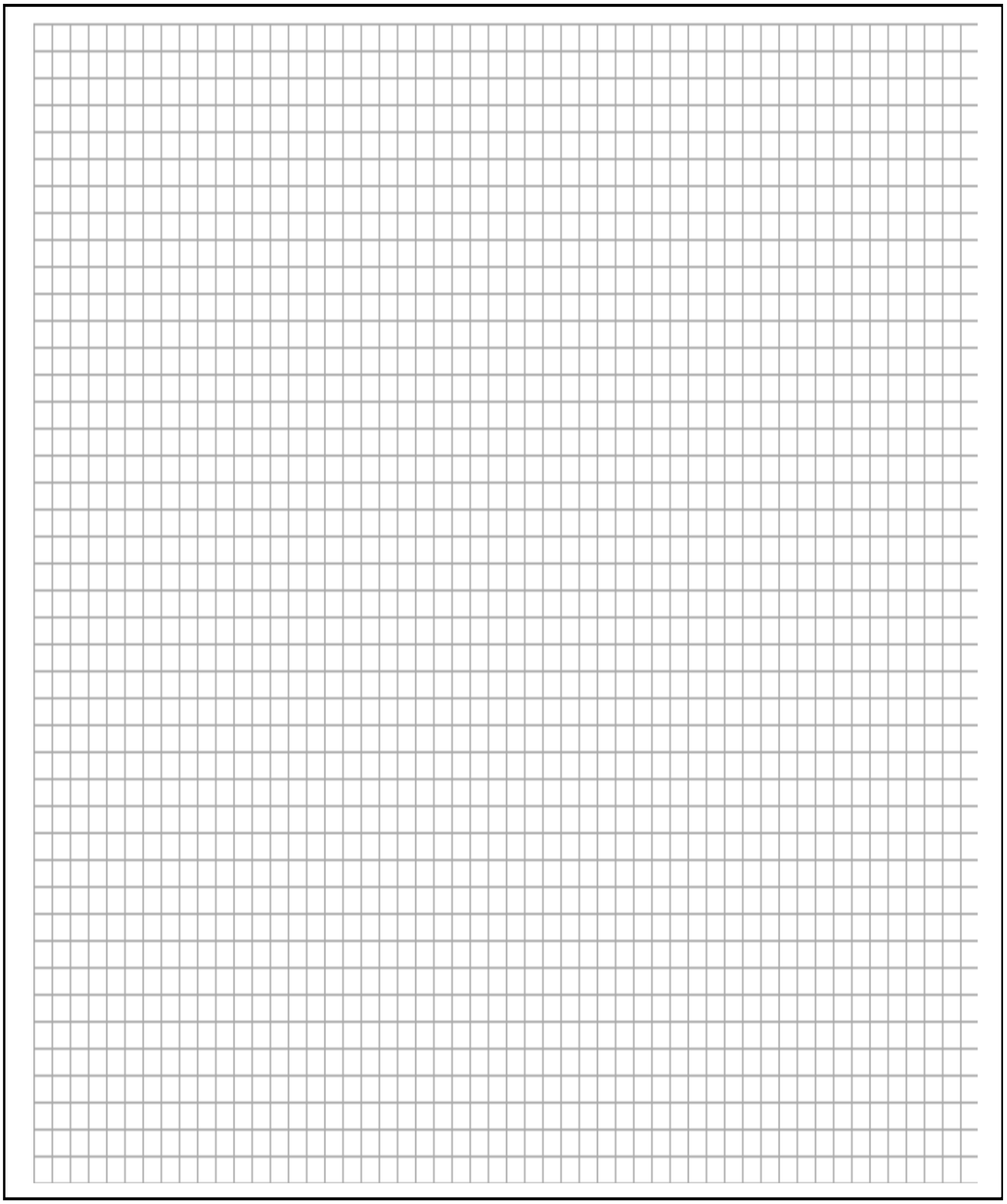
7. Model Graph:

:



Outputwaveform:

8. Graph:



Observed Waveforms

9. Scheme of Evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software's PC simulationsoftwares B)Identifying major sections (amplifier & Feedback section) C) Identification of test points in circuit	5	
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respective group of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit inworkspace.	1 5	
Simulation and result analysis	A. Run the simulation and rctify the errors if any by modifying the connections B.Adjust the capacitance and inductance values of the tank circuit to get the sustained oscillations C.Note down the time period and amplitude of the output waveform D.Plotting output waveform on graph sheet E.Calculate the frequency of oscillations from the output waveform F.Verify the theoretical and practical frequencies.	25	
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	5	

WORK SHEET

Name of the student :		Date of experiment:
PIN :	Branch:	
Institution:		Experiment No.

1. Title of the Experiment: _____

2. Objective of the Experiment: _____

3. Equipment Required: _____

_____

4. Circuit Diagram:

5. Procedure:

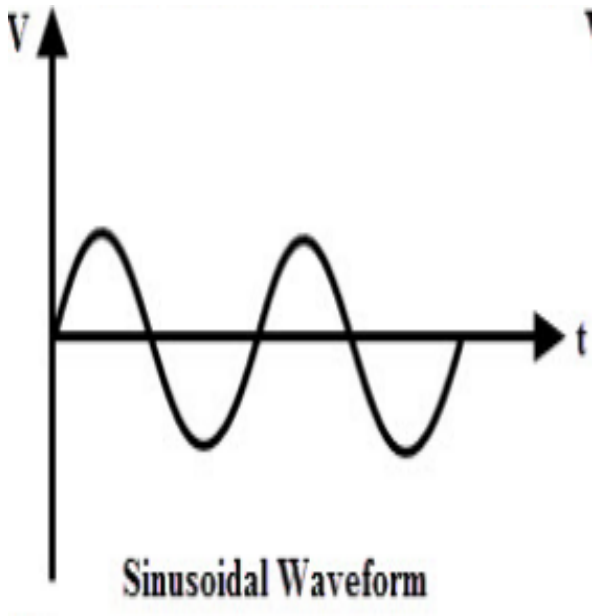
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

6. Readings:

S.NO	C (μF)	L_1 (Henry)	L_2 (Henry)	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1						
2						
3						
4						

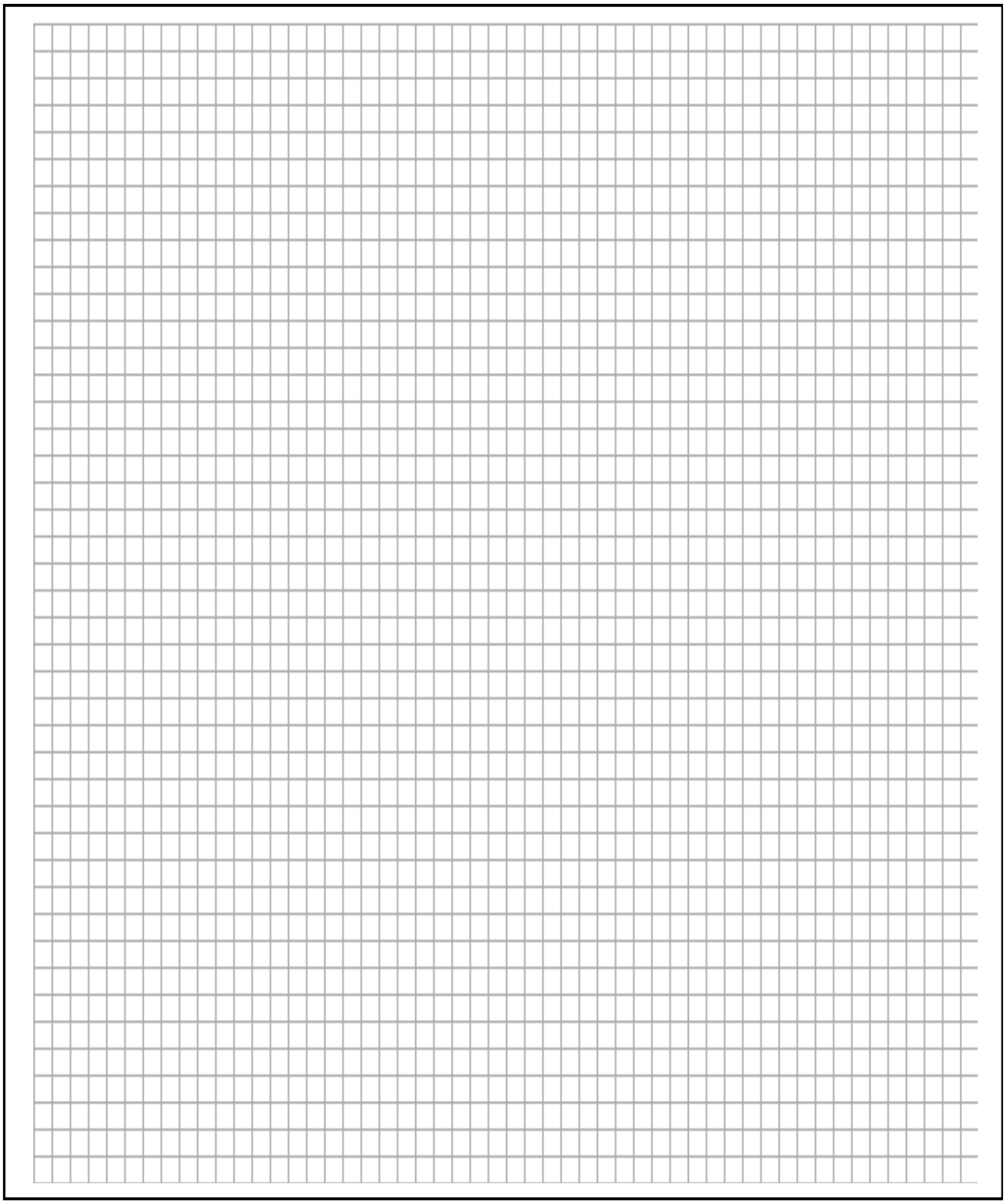
7. Model Graph:

:



Outputwaveform:

8. Graph:



Observed Waveforms

9. Scheme of Evaluation:

Category of skill	Subtask	WEIGHTAGE WITH COMPETENCY LEVEL INDIVIDUALLY	TOTAL
Familiarization of PSPICE software/Multisim	A) Working with Desktop PC simulation software'sPC simulationsoftwares B)Identifying major sections (amplifier & Feedback section) C) Identification of test points in circuit	5	
Preparation of schematic using PSPICE	A. Identification of various tool box and workspace B.Select the required components from the respectivegroup of library C. Set the values of components as per the requirement D. Make the connections as per the Circuit in workspace.	1 5	
Simulation and result analysis	A. Run the simulation and rectify the errors if any bymodifying the connections B.Adjust the capacitance and inductance values of the tank circuit to get the sustained oscillations C.Note down the time period and amplitude of the output waveform D.Plotting output waveform on graph sheet E.Calculate the frequency of oscillations from the output waveform F.Verify the theoretical and practical frequencies.	25	
Values	A)Co-operation B)Co-ordination C)Communication D)Sharing E)Leadership	5	
	TOTAL	50	

SIGNATURE OF STAFF **SIGNATURE OF STUDENT**

HALF WAVE RECTIFIER WITH AND WITHOUT FILTER

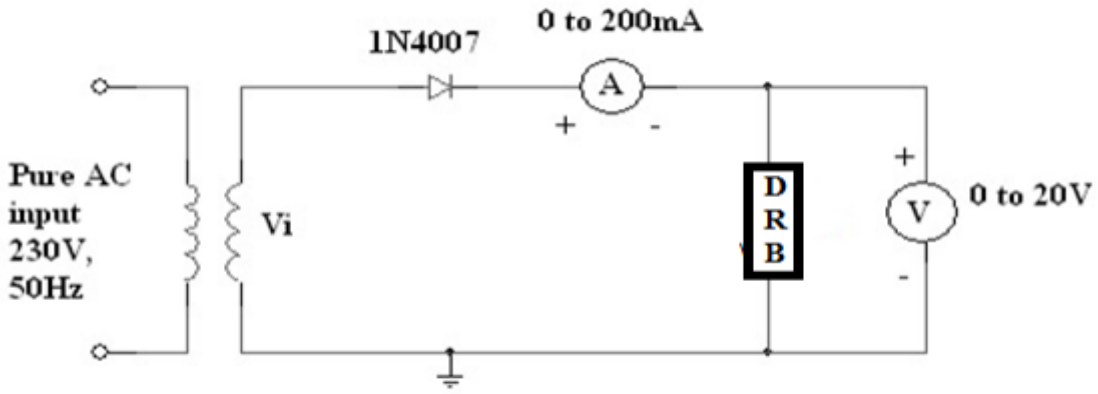
1. Description

The setup for this experiment requires the following equipment

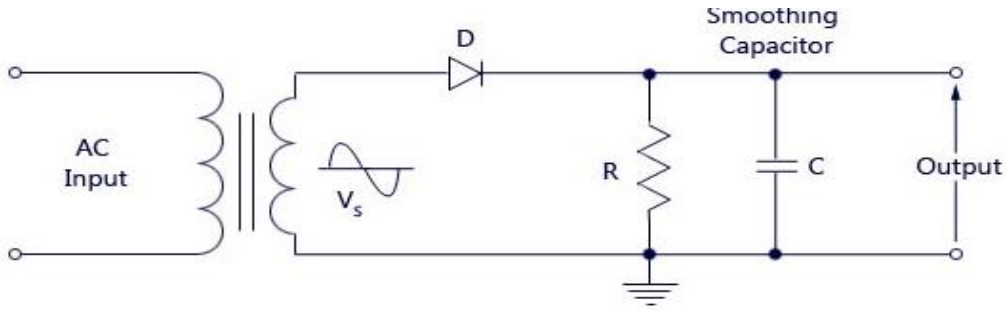
Name	Specifications/ Range	No	Purpose
Step-down transformer	230/9-0-9 V	1	To step down the A.C voltage
Diode	IN4007	1	To rectify the ac
Decade resistance box	10-1 M ohms	1	To adjust the load
DC ammeter	0-200 mA	1	To measure the current
DC Voltmeter	0-20v	1	To measure the DC voltage
AC voltmeter	0-20 V	1	To measure the AC voltage
C.R.O	Dual channel 0-20 M Hz	1	To display the wave forms
Breadboard		1	To make connections
Connecting Wires		As per need	To make connections
Capacitor	100uF	1	To filter the ripples

2. Circuit Diagram

Half wave rectifier without filter:



Halfwave rectifier with filter:



3. Theory

A rectifier is a circuit, which converts AC into DC .When the AC voltage is appliedtotheHalf wave rectifier. During positive half cycle the diode becomes forward biased and conducts the current. Hence the current flows through the load resistor.

During negative half cycle the diode becomes reverse biased and does not conducts the current .hence no current flows through the load resistor. So only positive half cycles will appear in the output and negative half cycles are clipped.

Ripple factor can be calculated by using the formula

Ripple factor=Vac /Vdc

Percentage of regulation can be calculated by using the formula

Percentage of regulation = (V nl – Vfl) / V fl *100

4. Procedure.

Without Filter:

1. **Make connections** as per the **circuit diagram.**
2. **Switch on** the **power supply.**
3. **Remove** the **load resistor** and **measure** the **no load voltage.**
4. **Connect** the **load** resistor.
5. **Measure** the current (**Idc**),volages (**Vdc&Vac**)
6. **Calculate ripple factor** and **percentage of regulation**
7. **Connect CRO** across the load resistor.
8. **Observe** the output **waveform** in CRO

With Filter:

1. **Connect** the Filter across load resistor
2. **Remove** the **load resistor** and **measure** the **no load voltage.**
3. **Connec**t the **load** resistor.
4. **Measure** the current (**Idc**),voltages(**Vdc**&**Vac**)
5. **Calculate ripple factor** and **percentage of regulation**

6. **Connect CRO** across the load resistor.
7. **Observe** the output **waveform** in CRO

5. Observations

Without filter:

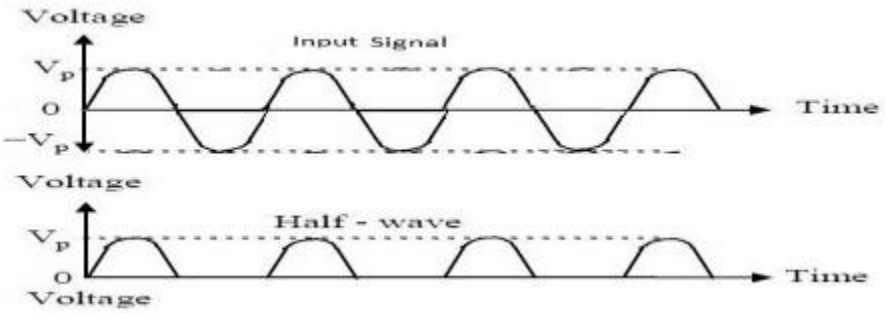
S.No.	DC current Idc (mA)	DC Voltage Vdc (V)	AC voltage Vac (V)	Ripple factor = Vac / Vdc	% of regulation

With filter:

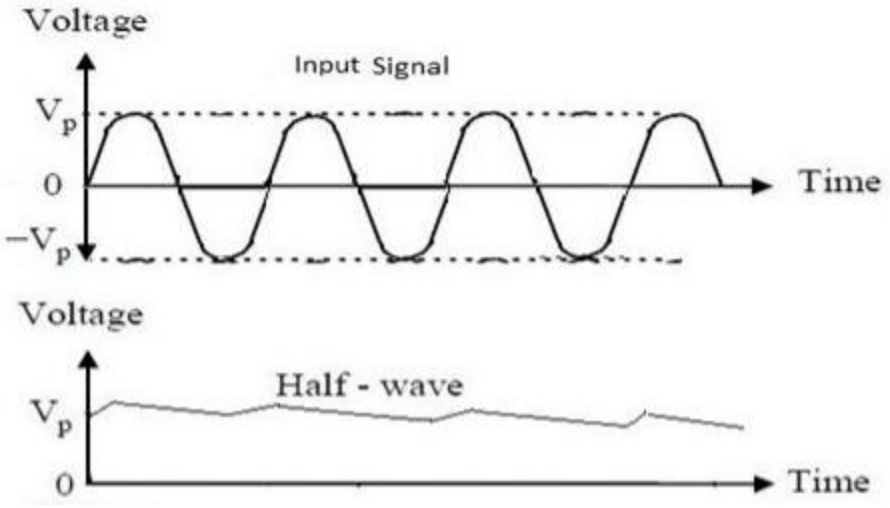
S.No.	DC current Idc (mA)	DC Voltage Vdc (V)	AC voltage Vac (V)	Ripple factor = Vac / Vdc	% of regulation

6. Model Graph

Without filter:



With filter:



7. Calculations Use the following formulae for calculations

Ripple factor=V_{ac}/ V_{dc}

Percentage of regulation =((V nl – Vfl) / V fl) *100

8. Precautions:

- Ensure the correct range of meters.
- The primary and secondary sides of the transformer should be carefully identified.
- The polarities of the diode should be carefully identified.
- Connect the circuit as per circuit diagram.
- Loose connections should be avoided.
- Get the connections checked by the concerned staff member.
- Give required supply voltage to the circuit.

EXPERIMENTAL METHODOLOGY 4.2. CENTER TAPPED FULL WAVE RECTIFIER

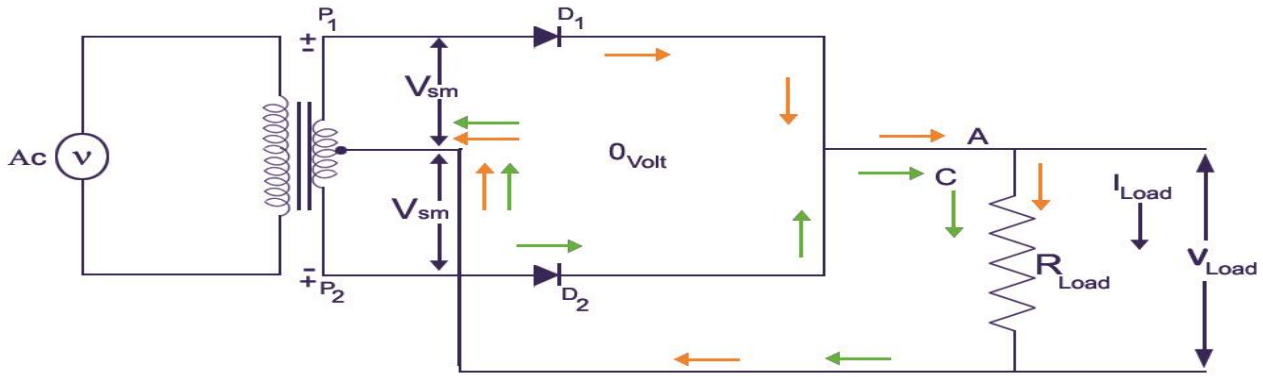
CENTER TAPPED FULL WAVE RECTIFIER

1. Description:

The setup for this experiment requires the following equipment

Sl No.	Name	Specifications/ Range	No	Purpose
1	Ammeter	(0-20) mA	1	To observe Load current I_L
2	Voltmeter	(0-50)V	1	To observe Load voltage V_L
3	DRB	10Ω-10KΩ	1	To adjust Load resistance
4	CRO	0-20MHz	1	To observe input and output waveforms.
5	Diodes	IN4007	2	For rectification
6	Resistor	1KΩ	1	To get output across it.
7	Capacitor	1000µF	1	To filter AC
8	Transformer with center tapped Secondary	(12-0-12)V	1	For step-down the 230V AC into 12V AC
9	Bread Board		1	To inter connect the components on it.
10	Connecting wires	Red, Blue, single strand ,suitable length		To make connections and inter connections to equipment.

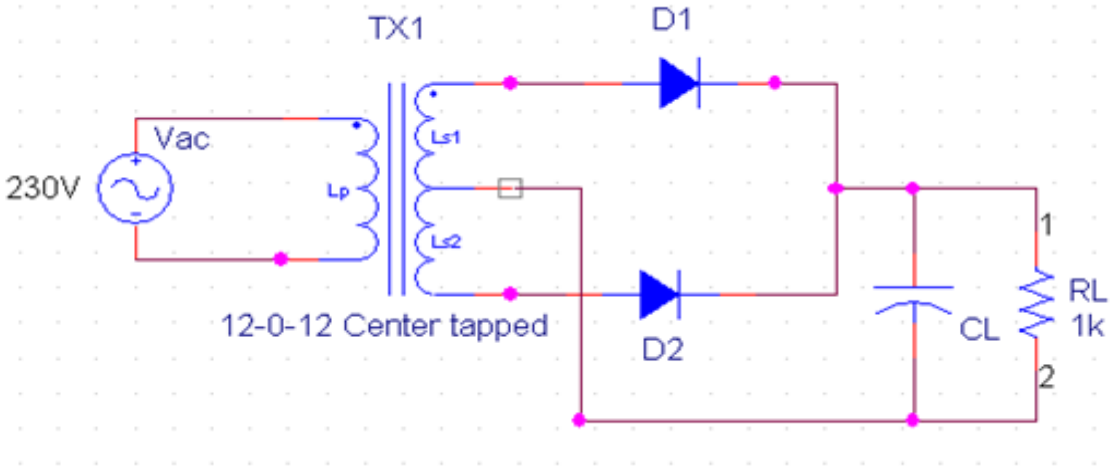
2. Circuit Diagram: **a) Without Filter:**



CENTRE - TAP FULL- WAVE RECTIFIER CIRCUIT

www.CircuitsToday.com

b) With Filter:



3. Theory:

The conversion of AC into pulsating DC is called Rectification. Electronic Devices can convert AC power into DC power with high efficiency.

The full-wave rectifier consists of a center-tapped transformer, which results in equal voltages above and below the center-tap. During the positive half cycle, a positive voltage appears at the anode of D1 while a negative voltage appears at the anode of D2. Due to this diode D1 is forward biased. It results a current Id1 through the load R.

During the negative half cycle, a positive voltage appears at the anode of D2 and hence it is forward biased, resulting a current Id2 through the load. At the same instant a negative voltage appears at the anode of D1, reverse biasing it and hence it doesn't conduct.

4. Procedure:

1. Connect the circuit as shown in the circuit diagram.
2. Connect the primary side of the transformer to AC mains and the secondary side to rectifier input.
3. Using a CRO, measure the maximum voltage V_m of the AC input voltage of the rectifier and AC voltage at the output of the rectifier.
4. Using a DC voltmeter, measure the DC voltage at the load resistance.
5. Observe the Waveforms at the secondary windings of transformer and across load resistance for a load of 1K.

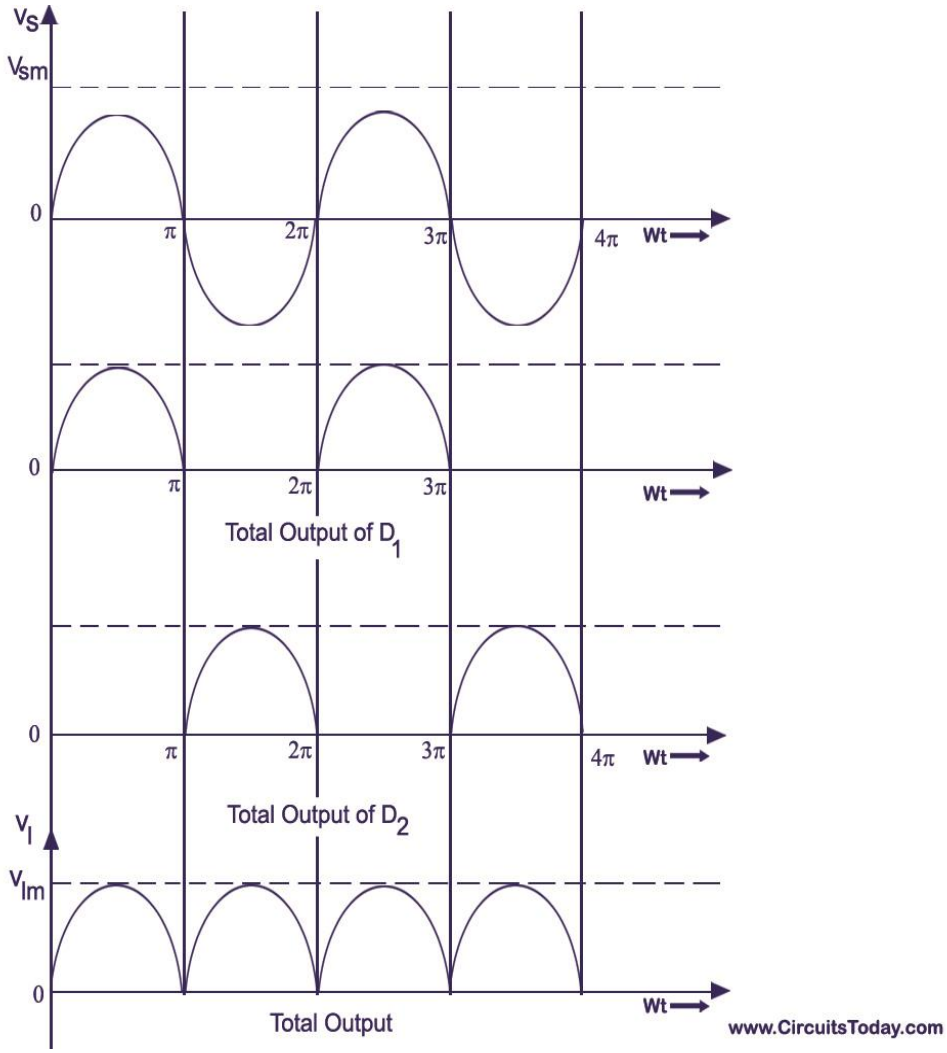
5. Observations:

1. Peak Voltage, V_m = _____ (From CRO for FWR with and without filter)
2. DC Voltage, $V_{DC(full\ load)}$ = _____ (From Multimeter for FWR with and without Filter)
3. No Load DC Voltage, $V_{DC(No\ load)}$ =_____(From Multimeter for FWR with and without filter)
4. Ripple Voltage, V_r = _____ (From CRO for FWR with filter)

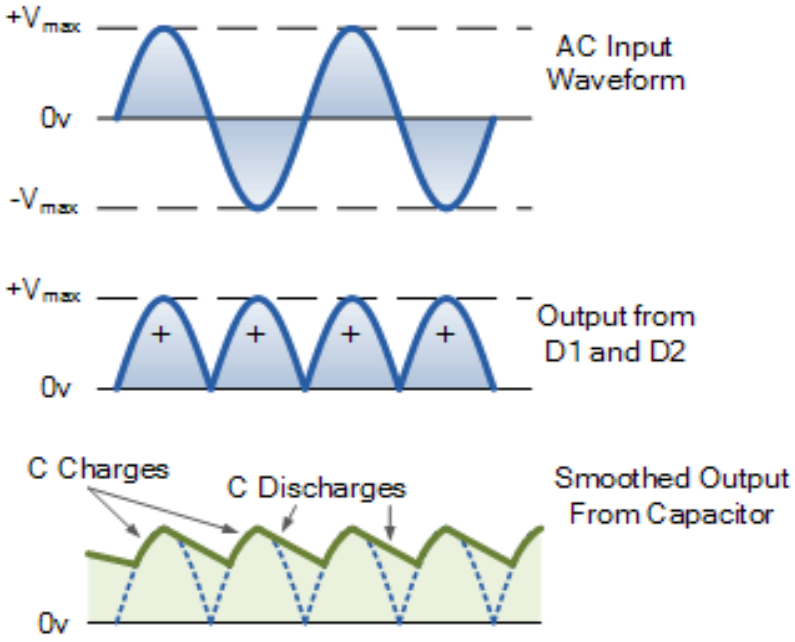
Type of the Rectifier	Ripple Factor		Efficiency		% of Regulation
	Theoretical	Practical			
FWR Without Filter					
FWR with Filter					

6. Graph:

a) Without Filter:



b) With Filter:



7. Calculations:

a) Without Filter	**b)With Filter:**
$V_{rms} = V_m/\sqrt{2}$ Ripple factor (Theoretical) $\gamma = \sqrt{\left(\frac{V_{rms}}{V_{DC}}\right)^2 - 1}$ = 0.48 Ripple factor (Practical) $\gamma = \frac{V_{ac}}{V_{dc}}$	**Ripple factor (Theoretical)** $\frac{1}{4\sqrt{3}fCR}$ **Ripple factor (Practical)** V_{ac}/V_{dc}

Efficiency:

$$\eta = \frac{(V_{dc})^2}{(V_{ac})^2}$$

% of Regulation

$$(\frac{V_{NL} - V_{FL}}{V_{FL}}) * 100$$

8. PRECAUTIONS

A. PROCEDURAL PRECAUTIONS:

- Disconnect all the equipment from mains before making connections
- Ensure the correct range of meters
- Connect the circuit as per the circuit diagram and check for polarity
- Get the connections checked by the concerned staff member
- Calibrate the CRO for getting accurate result.
- Use the proper Transformer.
- Ensure that there are no loose connections
- Filter capacitor should be connecting with proper polarity.

B. SAFETY PRECAUTIONS:

- Never work on a circuit while power is applied.
- Do not connect power to a circuit until the circuit is finished and you have carefully checked your work.
- If you smell anything burning, immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry.
- Always wear safety goggles.

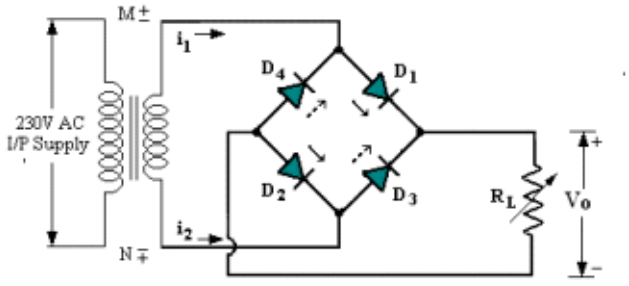
BRIDGE RECTIFIER

1. Description

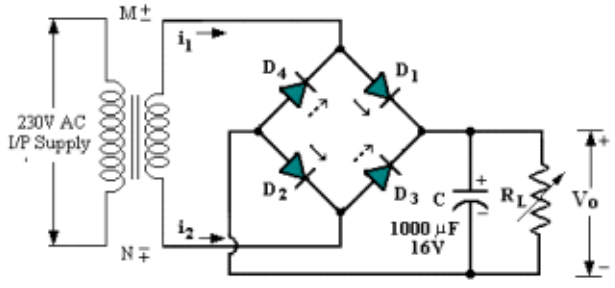
The setup for this experiment requires the following equipment

Name	Specification/range	Quantity	Purpose
Breadboard	-	1	To connect the components
Diodes	1N4007	4	FOR REGULATION
DRB		1	FOR GETTING VARIABLE RESISTANCES
C.R.O	-	1	To observe the output waveforms
Capacitors	1000µf	1	FOR FILTERING RIPPLES
Connecting wires			TO Connect components
Transformer	9-0-9	1	To step-down voltage

CIRCUIT DIAGRAM



Bridge Rectifier without filter



Bridge Rectifier with capacitor filter

Theory

A device is capable of converting a sinusoidal input waveform into a unidirectional waveform with non-zero average component is called a rectifier. The Bridge rectifier is a circuit, which converts an ac voltage to dc voltage using both half cycles of the input ac voltage.

The Bridge rectifier has four diodes connected to form a Bridge. The load resistance is connected between the other two ends of the bridge. For the positive half cycle of the input ac voltage, diode D1 and D2 conducts whereas diodes D3 and D4 remain in the OFF state. The conducting diodes will be in series with the load resistance RL and hence the load current flows through RL. For the negative half cycle of the input ac voltage, diode D3 and D4 conducts whereas diodes D1 and D2 remain in the OFF state. The conducting diodes will be in series with the load resistance RL and hence the load current flows through RL in the same direction as in the previous half cycle. Thus a bidirectional wave is converted into a unidirectional wave.

Ripple factor is a measure of effectiveness of a rectifier circuit and defined as a ratio of RMS value of ac component to the dc component in the rectifier output.

Procedure

WITHOUT FILTER:

1. Connecting the circuit on bread board as per the circuit diagram.
2. Connect the primary of the transformer to main supply i.e. 230V, 50Hz
3. Connect the decade resistance box and set the R_L value to 100Ω
4. Connect the Multimeter at output terminals and vary the load resistance (DRB) from 100Ω to 1KΩ and note down the Vac and Vdc as per given tabular form
5. Disconnect load resistance (DRB) and note down no load voltage Vdc ($V_{\text{no load}}$)
6. Connect load resistance at 1KΩ and connect Channel – II of CRO at output terminals and CH – I of CRO at Secondary Input terminals observe and note down the Input and Output Wave form on Graph Sheet.
7. Calculate ripple factor $\gamma = \frac{V_{ac}}{V_{dc}}$
8. Calculate Percentage of Regulation, $\%\eta = \frac{V_{\text{no load}} - V_{\text{full load}}}{V_{\text{no load}}} * 100\%$

WITH CAPACITOR FILTER:

1. Connecting the circuit on bread board as per the circuit diagram.
2. Connect the primary of the transformer to main supply i.e. 230V, 50Hz
3. Connect the decade resistance box and set the R_L value to 100Ω
4. Connect the Multimeter at output terminals and vary the load resistance (DRB) from 100Ω to 1KΩ and note down the Vac and Vdc as per given tabular form
5. Disconnect load resistance (DRB) and note down no load voltage Vdc ($V_{\text{no load}}$)
6. Connect load resistance at 1KΩ and connect Channel – II of CRO at output terminals and CH – I of CRO at Secondary Input terminals observe and note down the Input and Output Wave form on Graph Sheet.
7. Calculate ripple factor $\gamma = \frac{V_{ac}}{V_{dc}}$
8. Calculate Percentage of Regulation, $\%\eta = \frac{V_{\text{no load}} - V_{\text{full load}}}{V_{\text{no load}}} * 100\%$

Observations

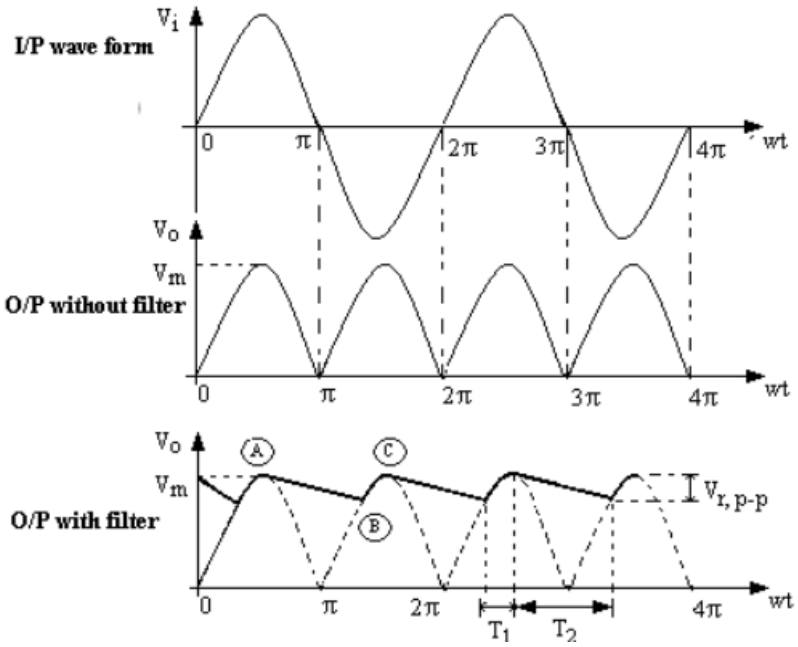
a) Without Filter

Sl No.	Load Resistance,RL(KΩ)	Vdc(Volts)	Vrms(Volts)	Ripple Factor	% of Regulation
01					
02					
03					
04					
05					

a) With Filter

Sl No.	Load Resistance, RL(KΩ)	Vdc (Volts)	Vrms (Volts)	Ripple Factor	% of Regulation
01					
02					
03					
04					
05					

Graphs



Precautions:

1. Connections should be tight.

2. Handling the Equipment Carefully.

3. Avoid parallax error while observing the values of waveforms on CRO.

ZENER DIODE AS VOLTAGE REGULATOR

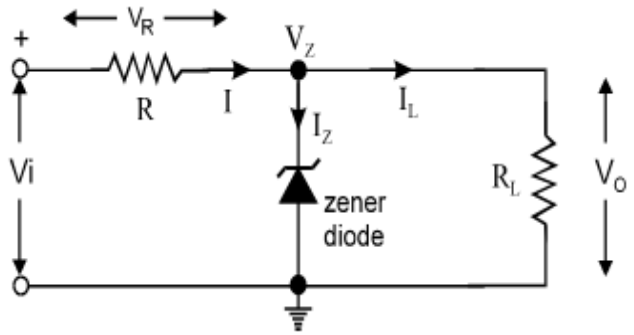
1. OBJECTIVE: To obtain the Voltage Regulation characteristics of Zener regulator.

2. Description

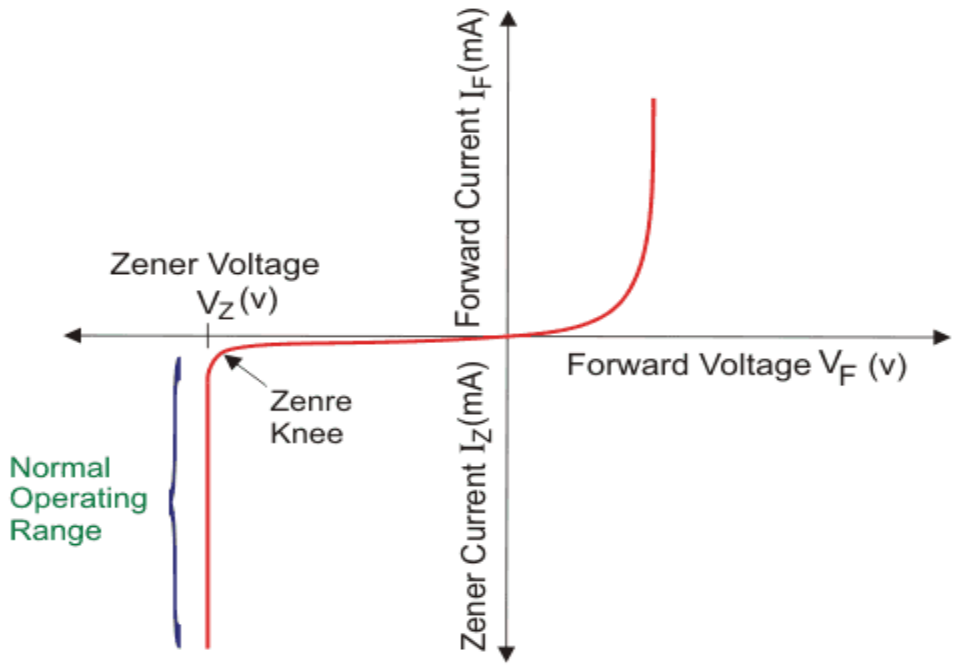
The setup for this experiment requires the following equipment

Name	Specifications/ Range	No	Purpose
Ammeter (MC)	(0-250)mA	**1**	To observe Load current I_f
Voltmeter(MC)	(0-30)V	**1**	To observe voltage across Zener Diode terminals
Resistance	1k, 2k, 3k	**1**	To get the load output voltages
ZENER DIODE	6.2 V Breakdown Voltage	**1**	To get the regulated output voltage
Connecting Wires	Red , Green, Blue , Yellow and Black 3/20 gauge , suitable lengths	As per the requirement	To make connections and interconnections to equipment

3. Circuit Diagram



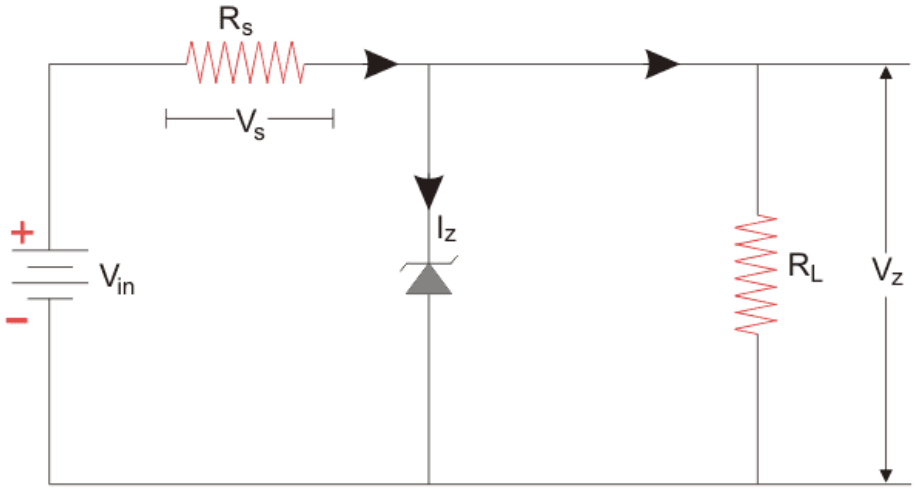
4. Theory



A Zener diode is heavily doped p-n junction diode, specially made to operate in the break down region. A p-n junction diode normally does not conduct when reverse biased. But if the reverse bias is increased, at a particular voltage it starts conducting heavily. This voltage is called Break down Voltage.

High current through the diode can permanently damage the device

To avoid high current, we connect a resistor in series with zener diode. Once the diode starts conducting it maintains almost constant voltage across the terminals what ever may be the current through it, i.e., it has very low dynamic resistance. It is used in voltage regulators.



5. PROCEDURE:-

Static characteristics:-

1. Connections are made as per the circuit diagram.

2. The Regulated power supply voltage is increased in steps.

3. The zener current (Iz), and the zener voltage (Vz.) are observed and then

Noted in the tabular form.

4. A graph is plotted between Zener current (Iz) and Zener voltage (Vz).

Regulation characteristics:-

1. The voltage regulation of any device is usually expressed as percentage regulation
2. The percentage regulation is given by the formula

$((V_{NL}-V_{FL})/V_{NL}$

V_{NL}=Voltage across the diode, when no load is connected.

V_{FL}=Voltage across the diode, when load is connected.

3. Connection are made as per the circuit diagram
4. The load is placed in full load condition and the zener voltage (Vz), Zener current (Iz), load current (I_L) are measured.
5. The above step is repeated by decreasing the value of the load in steps.
6. All the readings are tabulated.
7. The percentage regulation is calculated using the above formula

6. OBSERVATIONS:-

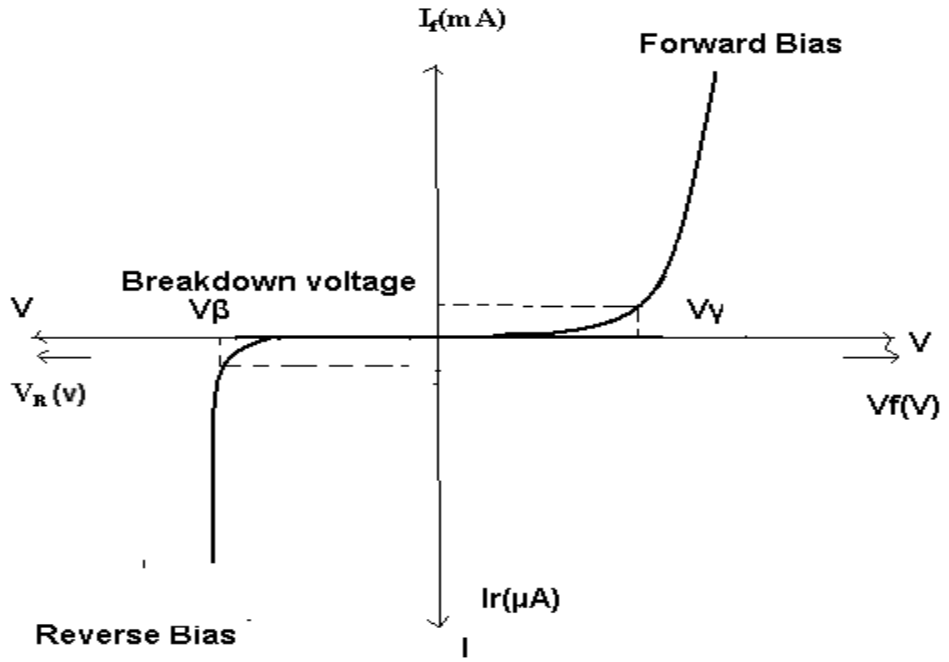
Static characteristics:-

S.NO	**ZENER VOLTAGE(V_Z)**	**ZENER CURRENT(I_Z)**

Regulation characteristics:-

S.N0	V_{NL}(VOLTS)	V_{FL} (VOLTS)	R_L (KΩ)	% REGULATION

7. GRAPH:



Model Graph:

8. CALCULATIONS:

The percentage regulation is given by the formula

$((V_{NL}-V_{FL})/V_{FL})X100$

V_{NL}=Voltage across the diode, when no load is connected.

V_{FL}=Voltage across the diode, when load is connected.

9. PRECAUTIONS:

A. Procedural precautions

1. Disconnect all the equipment from mains before making connections
2. Ensure the correct range of meters
3. Ensure that the meters and RPS and Zener Diode are connected properly.
4. Connect the circuit as per the circuit diagram and check for polarity of ZENER DIODE.
5. Get the connections checked by the concerned staff member.
6. Ensure that there are no loose connections.

B. Safety precautions:

1. The terminals of the Zener diode should be properly identified.

2. While determined the load regulation, load should not be immediately shorted.

3. Should be ensured be ensured that the applied voltages & currents do not exceed the ratings of the diode.

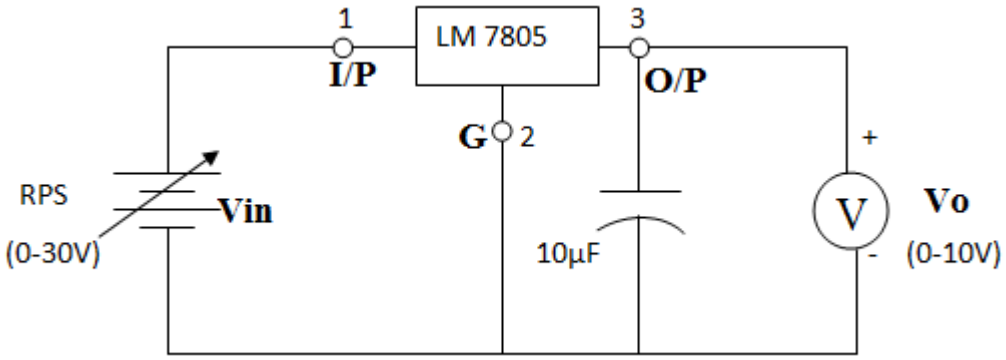
IC REGULATOR

1. Description

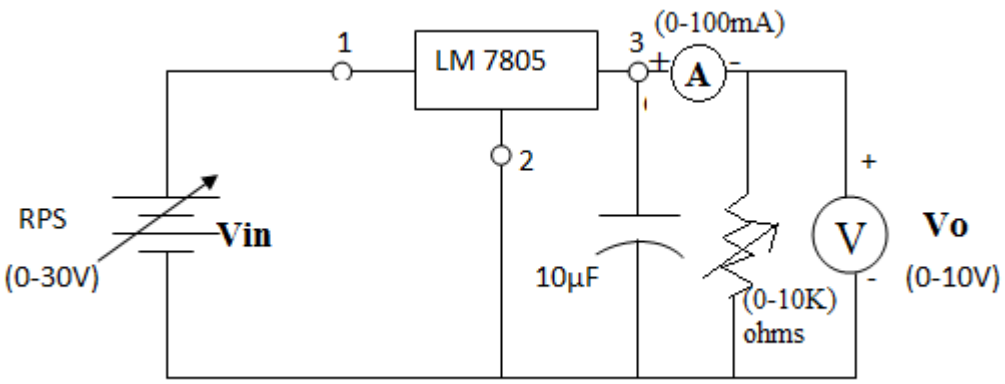
The setup for this experiment requires the following equipment

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	IC 7805		1	For positive voltage regulation
2	Capacitor	10µF	1	For filtering
		1 µF	1	For compensation
3	Voltmeter	(0-30)V MC	1	To measure output voltage
4	Breadboard		1	To Develop the circuit
5	Connecting wires		required number	To Interconnect the components
6	Regulated powersupply	0-30V	1	To provide biasing

2.Circuit diagram:



1(a) Line Regulation using 3-terminal +Ve Regulator IC



1(b) Load Regulation using 3-terminal +Ve Regulator IC

3.Theory:

Voltage regulator IC can be defined as an integrated circuit that is capable of supplying a constant controlled output voltage which is not at all affected by the variations in input voltage provided that the variations are within the prescribed limits under specified atmospheric conditions. Voltage fluctuations may damage or reduce the life of circuit components. Usage of voltage regulator ICs helps in avoiding such events by maintaining voltage at the required levels.

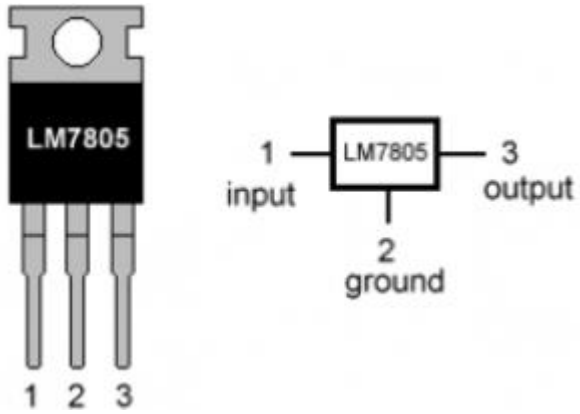
IC 78xx

IC 78xx is a three pin negative voltage controller IC. It is a small integrated circuit used in a circuit to supply a constant negative input voltage. The number 78 indicates that it is a positive voltage regulator and xx indicates the output voltage of the IC. 'xx' can be replaced by the controlled output voltage provided by the regulator, for example, if it is 7805, then the output voltage of the IC is 5 V. Similarly if it is 7812, then output voltage of the IC is 12 volts and so on. The name of the IC may vary based on the manufacturer as LM78xx, L78xx, MC78xx etc.

IC 78xx requires heat sink for its safe operation. Heat sink boosts heat dissipation therefore the life of the device can be extended.

79xx ICs and Output Voltages

IC Number	Output Voltage
7805	05 Volts
7812	12 Volts
7815	15 Volts
7818	18 Volts



4. Procedure:

1. **Connect** the **circuit** as per **circuit diagram**

2. **SWITCH-ON** the **supply**

3. **Vary** the **RPS** voltages for **different** values **Note down** corresponding **output voltage**

4. **Observe** that output **voltage constant.**

5. Observations:

Table: 1 Line Regulation for 7805:

S.No.	Unregulated Power Supply V_{in}(V)	Regulated Output Voltage V_O(V)

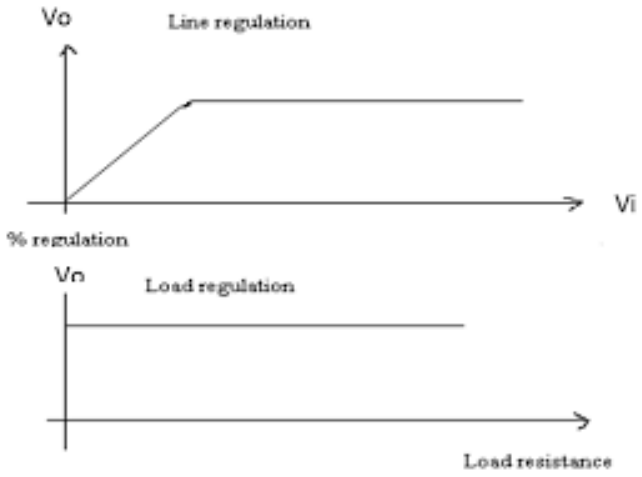
Table: 2 Load Regulation for 7805:

Input Supply Voltage V_{in} = _____ Volts

No-load DC Voltage, V_{NL} = _____ Volts

S.No.	Load Resistance R_L(K)	Unregulated Power Supply V_{in}(V	Regulated Output Voltage V_O (V)	% Voltage Regulation

6.Graph:



7.Calculations:

%regulation=(Vi-V $_o$/V$_o$)*100

8. Precautions:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B . Safety precautions

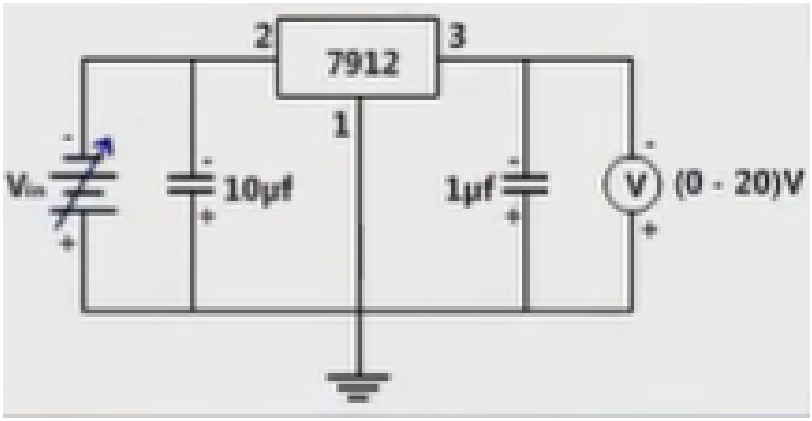
- Never make connections on a circuit when supply is in ON position
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry
- Always wear safety goggles

1. Description

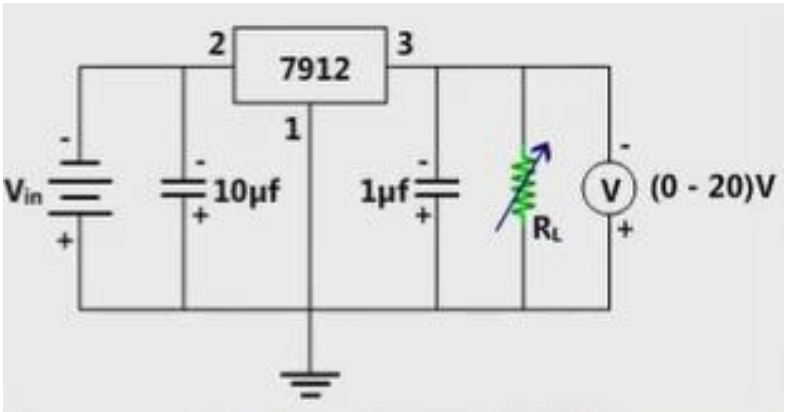
The setup for this experiment requires the following equipment

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	IC 7912 or 7905		1	For Negative voltage regulation
2	Capacitor	10µF	1	For filtering
		1 µF	1	For compensation
3	Voltmeter	(0-30)V MC	1	To measure output voltage
4	Breadboard		1	To Develop the circuit
5	Connecting wires		required number	To Interconnect the components
6	Regulated powersupply	0-30V	1	To provide biasing

2.Circuit diagram:



1(a) Line Regulation using 3-terminal -Ve Regulator IC



1(b) Line Regulation using 3-terminal -Ve Regulator IC

3. Theory:

Voltage regulator IC can be defined as an integrated circuit that is capable of supplying a constant controlled output voltage which is not at all affected by the variations in input voltage provided that the variations are within the prescribed limits under specified atmospheric conditions. Voltage fluctuations may damage or reduce the life of circuit components. Usage of voltage regulator ICs helps in avoiding such events by maintaining voltage at the required levels.

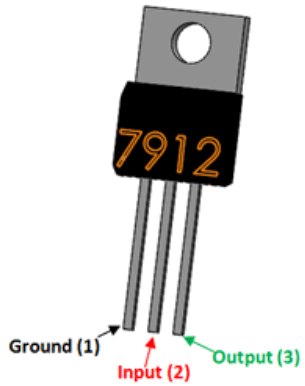
IC 79xx

IC 79xx is a three pin negative voltage controller IC. It is a small integrated circuit used in a circuit to supply a constant negative input voltage. The number 79 indicates that it is a negative voltage regulator and xx indicates the output voltage of the IC. 'xx' can be replaced by the controlled output voltage provided by the regulator, for example, if it is 7905, then the output voltage of the IC is -5 V. Similarly if it is 7912, then output voltage of the IC is -12 volts and so on. The name of the IC may vary based on the manufacturer as LM79xx, L79xx, MC79xx etc.

IC 79xx requires heat sink for its safe operation. Heat sink boosts heat dissipation therefore the life of the device can be extended.

79xx ICs and Output Voltages

IC Number	Output Voltage
7905	-05 Volts
7912	-12 Volts
7915	-15 Volts
7918	-18 Volts



4. Procedure:

1. **Connect** the **circuit** as per **circuit diagram**

2. **SWITCH-ON** the **supply**

3. **Vary** the **RPS** voltages for **different** values **Note down** corresponding **output voltage**

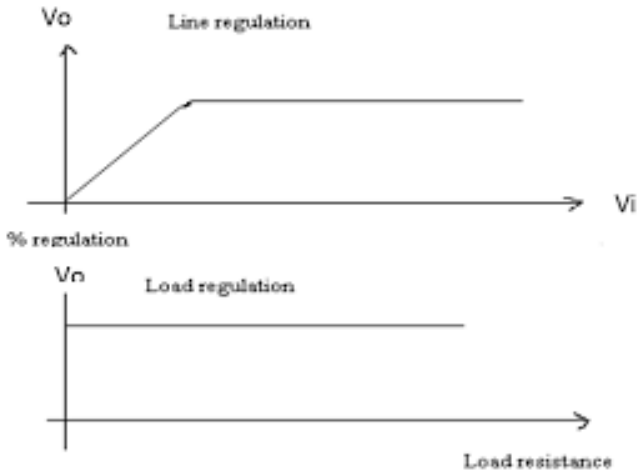
4. **Observe** that output **voltage constant.**

5. Observations:

When input voltage is equal to 12v or greater than 12v output voltage is 12v constant

s.l.no	INPUT VOLTAGE (Vin)	OUTPUT VOLTAGE(Vout)	% Regulation
1			
2			
3			
4			
5			
6			
7			
8			

6.Graph:



7.Calculations:

%regulation=(Vi-V $_o$/V$_o$)*100

8. Precautions:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B . Safety precautions

- Never make connections on a circuit when supply is in ON position
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry
- Always wear safety goggles

IC REGULATOR

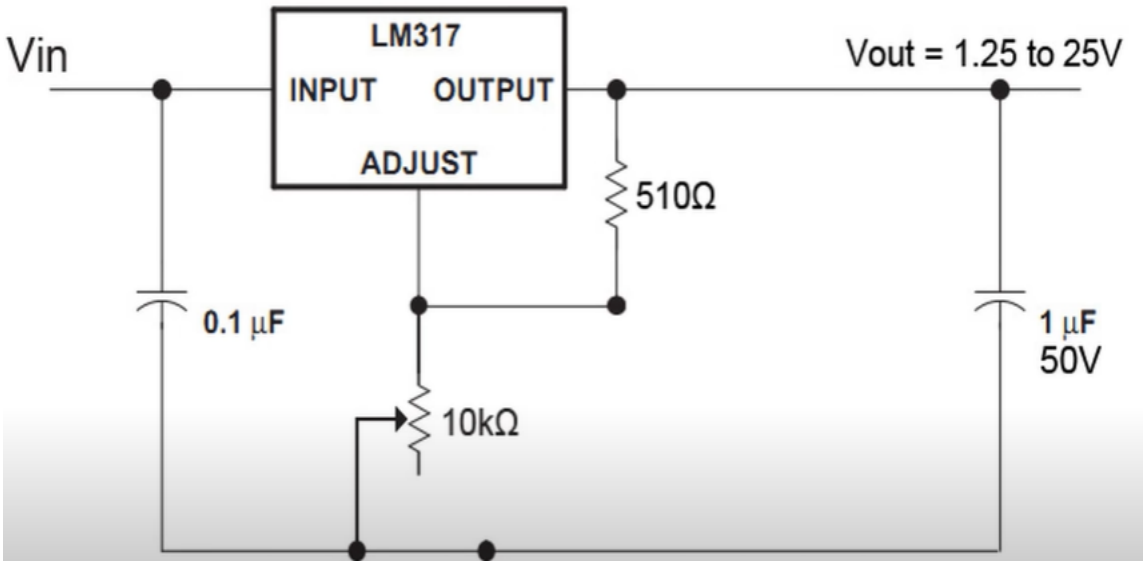
Objective:

1. Description

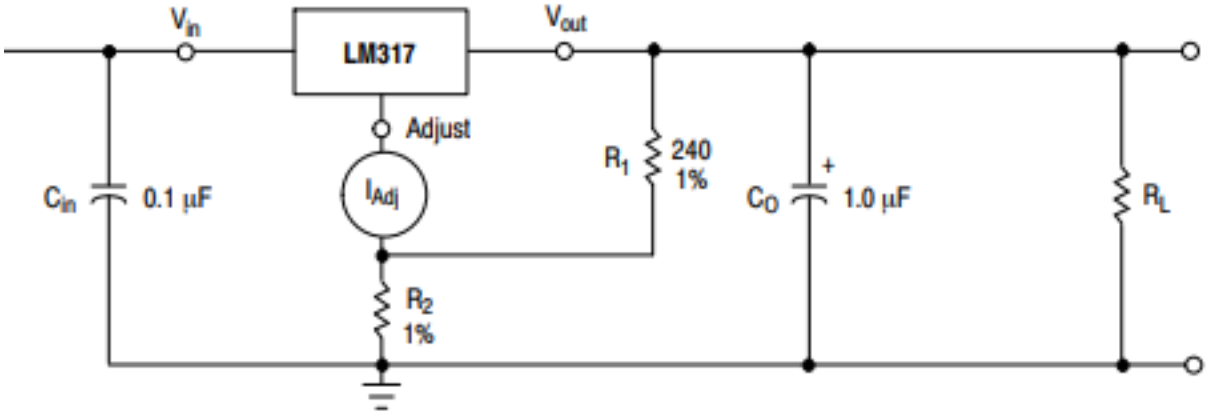
The setup for this experiment requires the following equipment

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	LM317		1	For adjustable voltage regulation
2	Capacitor	1µF	1	For filtering
		0.1 µF	1	For compensation
3	Voltmeter	(0-30)V MC	1	To measure output voltage
4	Breadboard		1	To Develop the circuit
5	Connecting wires		required number	To Interconnect the components
6	Regulated powersupply	0-30V	1	To provide biasing

2.Circuit diagram:



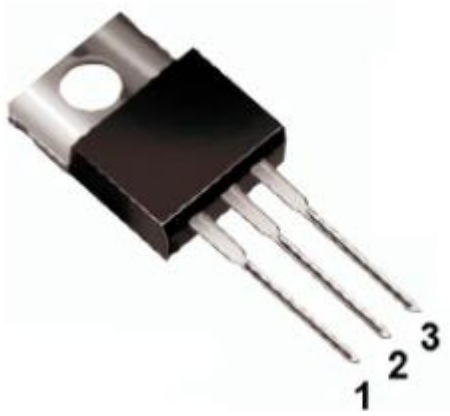
1(a) Line Regulation using 3-terminal +Ve Regulator IC



1(b) Load Regulation using 3-terminal LM317 Regulator IC

3.Theory:

IC LM 317 is an adjustable linear voltage regulator. LM 317 has 3 pin. Input, Output and adjustment. Its output voltage range is from 1.25 - 37 V and maximum output current is 1.5A. The device is conceptually an op-amp with relatively high output current capacity. The noninverting input of the op-amp is the adjustment pin while the inverting input is set by an internal voltage reference of 1.25V. A resistive voltage divider between the output and ground configures the op-amp as a non-inverting amplifier. So that the voltage of the output pin is continuously adjusted to a fixed amount of reference voltage. In the circuit transformer steps down to AC 230V to 12V and is applied to bridge rectifier diodes D1 to D4. C1 and C2 are filter capacitors. Capacitor C3 is for the better performance of filter IC. The output voltage from IC depending on the voltage ADJ pin of the IC. The voltage across variable resistor R2 controls the DC output. Vout = 1.25 (1 + R1 / R2) . By varying the resistor R2 DC output voltage can be varied



1. Adjust
2. Vout
3. Vin

4. Procedure:

1. **Connect** the **circuit** as per **circuit diagram**

2. **SWITCH-ON** the **supply**

3. **Vary** the **RPS** voltages for **different** values **Note down** corresponding **output voltage**

4. **Observe** that output **voltage constant.**

5. Observations:

Table: 1 Line Regulation for LM317:

S.No.	Unregulated Power Supply V_{in}(V)	Regulated Output Voltage V_O(V)

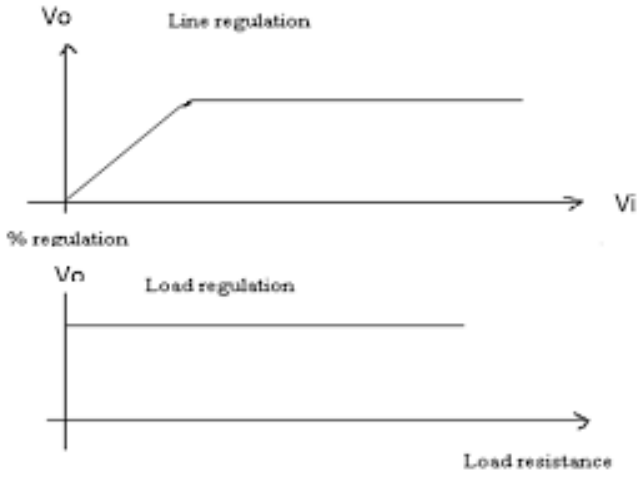
Table: 2 Load Regulation for LM317:

Input Supply Voltage V_{in} = _____ Volts

No-load DC Voltage, V_{NL} = _____ Volts

S.No.	Load Resistance R_L(K)	Unregulated Power Supply V_{in}(V	Regulated Output Voltage V_O (V)	% Voltage Regulation

6. Model waveform:



7.Calculations:

%regulation=(Vi-V $_o$/V_o)*100

8. Precautions:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions

- Never make connections on a circuit when supply is in ON position
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry
- Always wear safety goggles

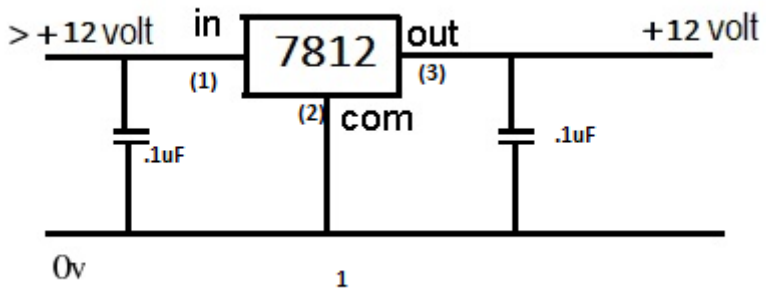
REGULATED POWER SUPPLY USING 78XX/79XX

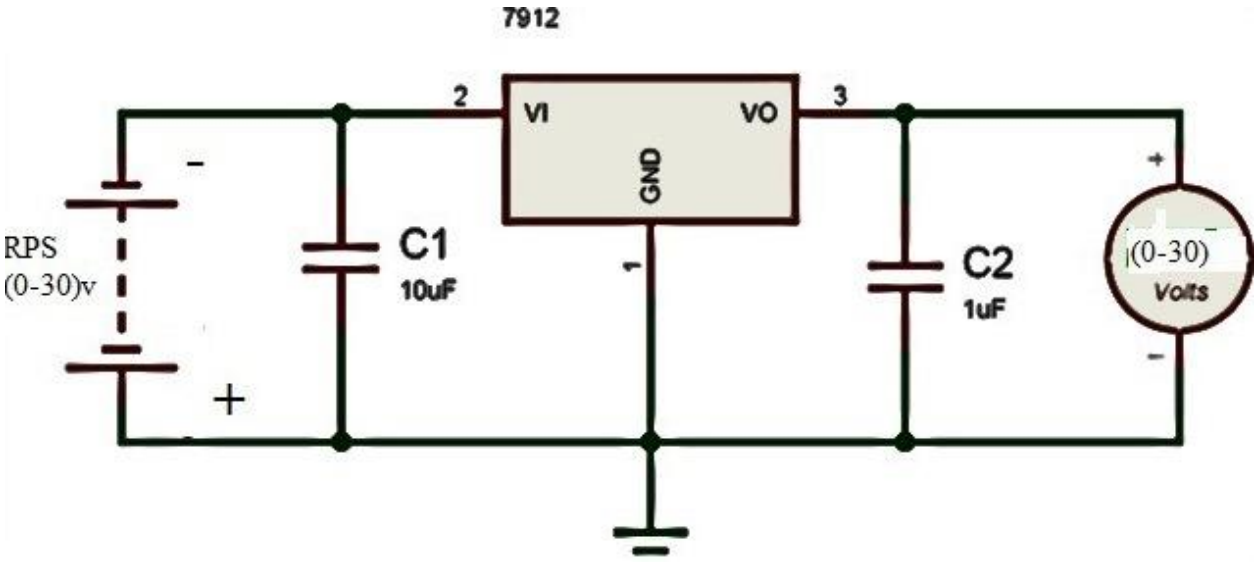
1. Description

The setup for this experiment requires the following equipment

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	IC 7805 or 7812 IC 7912 or 7905		1	For Negative voltage regulation
2	Capacitor	10µF	1	For filtering
		1 µF	1	For compensation
3	Voltmeter	(0-30)V MC	1	To measure output voltage
4	Breadboard		1	To Develop the circuit
5	Connecting wires		required number	To Interconnect the components
6	Regulated power supply	0-30V	1	To provide biasing

2.Circuit diagram:





3. Theory: Voltage regulator IC can be defined as an integrated circuit that is capable of supplying a constant controlled output voltage which is not at all affected by the variations in input voltage provided that the variations are within the prescribed limits under specified atmospheric conditions. Voltage fluctuations may damage or reduce the life of circuit components. Usage of voltage regulator ICs helps in avoiding such events by maintaining voltage at the required levels.

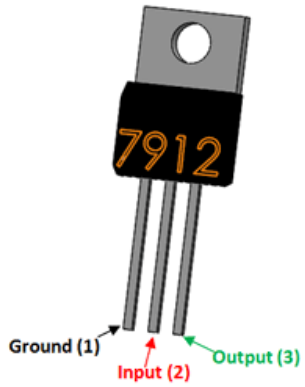
IC 79xx

IC 79xx is a three pin negative voltage controller IC. It is a small integrated circuit used in a circuit to supply a constant negative input voltage. The number 79 indicates that it is a negative voltage regulator and xx indicates the output voltage of the IC. 'xx' can be replaced by the controlled output voltage provided by the regulator, for example, if it is 7905, then the output voltage of the IC is -5 V. Similarly if it is 7912, then output voltage of the IC is -12 volts and so on. The name of the IC may vary based on the manufacturer as LM79xx, L79xx, MC79xx etc.

IC 79xx requires heat sink for its safe operation. Heat sink boosts heat dissipation therefore the life of the device can be extended.

79xx ICs and Output Voltages

IC Number	Output Voltage
7905	-05 Volts
7912	-12 Volts
7915	-15 Volts
7918	-18 Volts



4. Procedure:

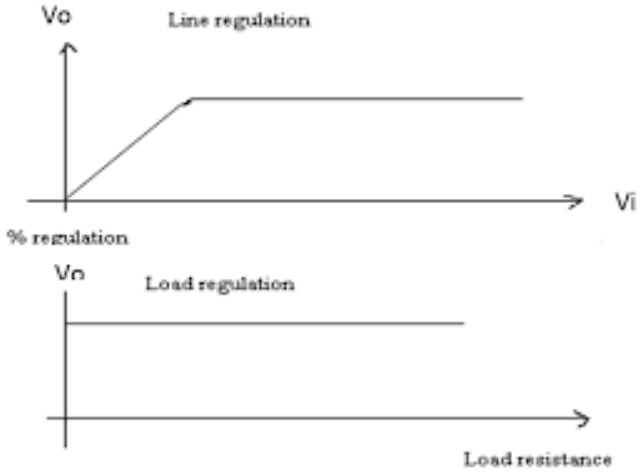
1. Connect the circuit as per circuit diagram
2. switch-on the supply
3. Vary the RPS voltages for different values Note down corresponding output voltage
4. Observe that output voltage constant.

5. Observations:

When input voltage is equal to 12v or greater than 12v output voltage is 12v constant

s.l.no	INPUT VOLTAGE (V_{in})	OUTPUT VOLTAGE(V_{out})	% Regulation
1			
2			
3			
4			
5			
6			
7			
8			

6.Graph:



7. Calculations:

%regulation=(Vi-V $_o$/V$_o$)*100

8. Precautions:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure the correct range meters
- Check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions

- Never make connections on a circuit when supply is in ON position
- If you smell anything burning , immediately disconnect the power and examine your circuit to find out what went wrong.
- Keep your work area dry
- Always wear safety goggles

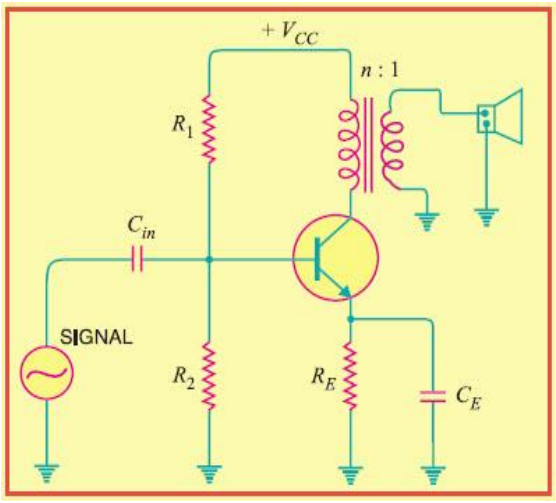
SINGLE STAGE TRANSFORMER COUPLED CE AMPLIFIER

1. Description:

The setup for this experiment requires the following equipment

Name	Specifications/ Range	No	Purpose
Regulated Power Supply	0-30V	1	To Bias the transistor
CRO	0-20MHz	1	To observe input and output waveforms
Digital Multimeter		1	To measure input and output voltages
Signal Generator	1Hz – 1MHz	1	To apply input signal with different frequencies
Resistors	R_1-- 4.3KΩ, R_2—5.7KΩ R_E -- 1KΩ R_{in}—2.2KΩ	1 Each	R_1,R_2 for biasing R_E for stabilization $R_{in}$for current limiting
Capacitors	C_E—10μF C_{in}--- 10μF	1 Each	C_E Emitter bypass capacitor C_{in} input coupling capacitor
Transistor	BC107	1	To amplify the signal
Driver Transformer		1	To couple the output
Connecting wires			

2.Circuit Diagram :



R_1 = 4.3KΩ, R_2 = 5.7KΩ, R_E = 1KΩ, C_{in} = 10μF, C_E = 10μF , V_{CC} = 10V & n:1 = 5:1

The transformer which is used as a coupling device in this circuit has the property of impedance changing, which means the low resistance of a stage (or load) can be reflected as a high load resistance to the previous stage. Hence the voltage at the primary is transferred according to the turns ratio of the secondary winding of the transformer.

This transformer coupling provides good impedance matching between the stages of amplifier. The transformer coupled amplifier is generally used for power amplification.

The gain of the amplifier is constant only for a small range of frequencies. The output voltage is equal to the collector current multiplied by the reactance of primary.

At low frequencies, the reactance of primary begins to fall, resulting in decreased gain. At high frequencies, the capacitance between turns of windings acts as a bypass condenser to reduce the output voltage and hence gain.

So, the amplification of audio signals will not be proportionate and some distortion will also get introduced, which is called as Frequency distortion.

4. Procedure

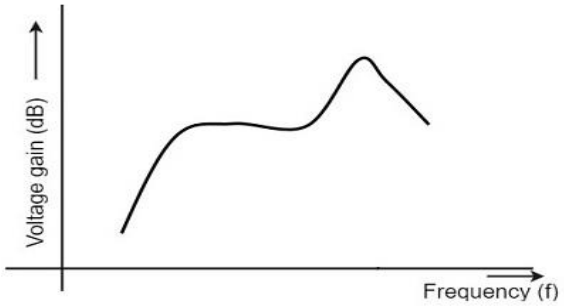
1. Make connections as per the circuit diagram.
2. Connect the CRO and Multi meter at the input and output terminals
3. Switch on the power supply
4. Set V_{in} (say 300 mV) at constant value using signal generator.
5. Keep input voltage constant,vary the frequency from 0 to 1MHz in regular steps
6. Notedown the corresponding output voltageacrossloudspeakerusingmultimeterand observe itin CRO
7. Calculate the gain of the amplifier in dB
8. Plot the graph between Gain(dB) and frequency (Hz)on logarithmic graph

5. Observations:

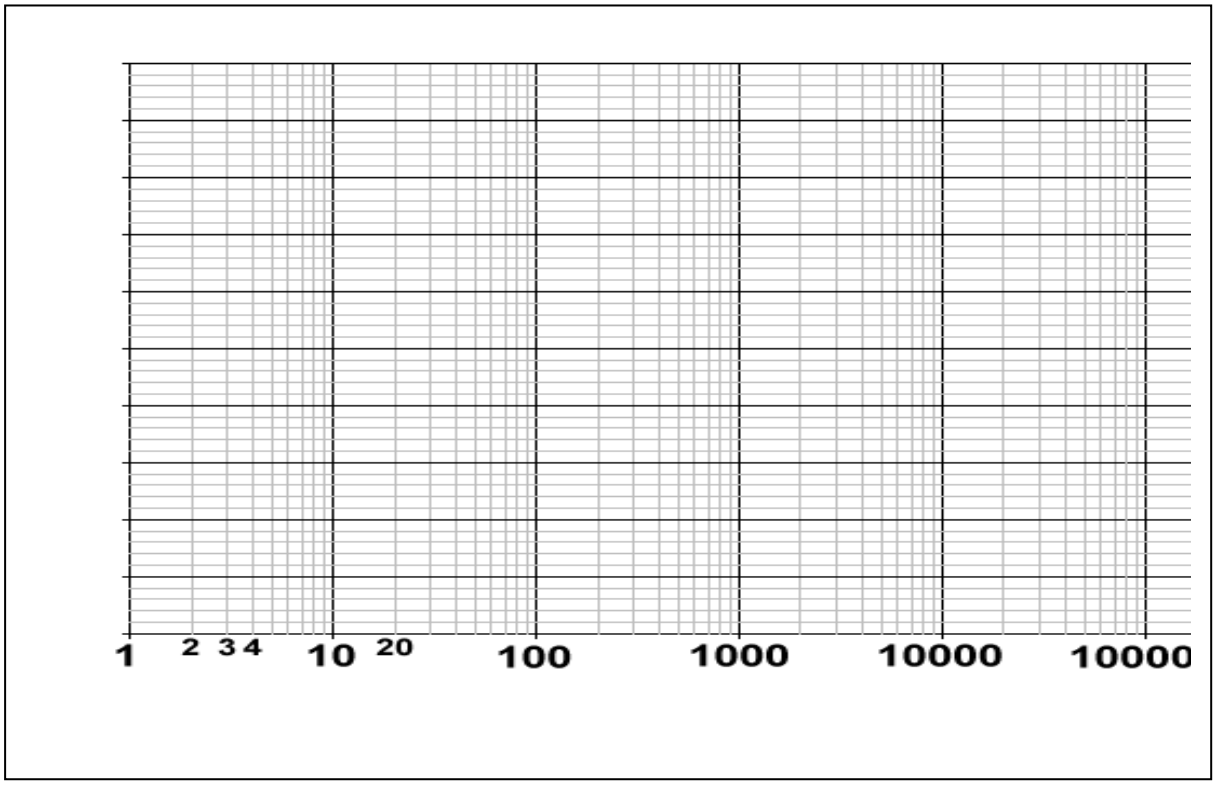
S.No	Input frequency	Input Voltage(in Volts)	Output voltage (in Volts)	Gain $\frac{V_0}{V_{in}}$	Gain in dB $20 \log \frac{V_0}{V_{in}}$
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Plot the graph between Gain(dB) Vs Frequency in logarithmic graph sheet

6.Model graph:



Practical graph



7. Calculations: Use the following formulae for calculations

Voltage Gain $A_V = \frac{V_O}{V_{in}}$

Voltage gain in dB = $20\log \frac{V_O}{V_{in}}$

8. Precautions:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Ensure the correct range of meters
- Ensure that the meters are properly set
- Ensure that the Transistor and Transformer connected properly
- Connect the circuit as per the circuit diagram and check for polarity
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Do not exceed the rated voltage
- Avoid parallax error

B. Safety precautions:

- Shoes must be worn at all times.
- No part of a live circuit should be touched by the bare hand.
- Always check to see that the power switch is OFF before plugging and unplugging from the outlet

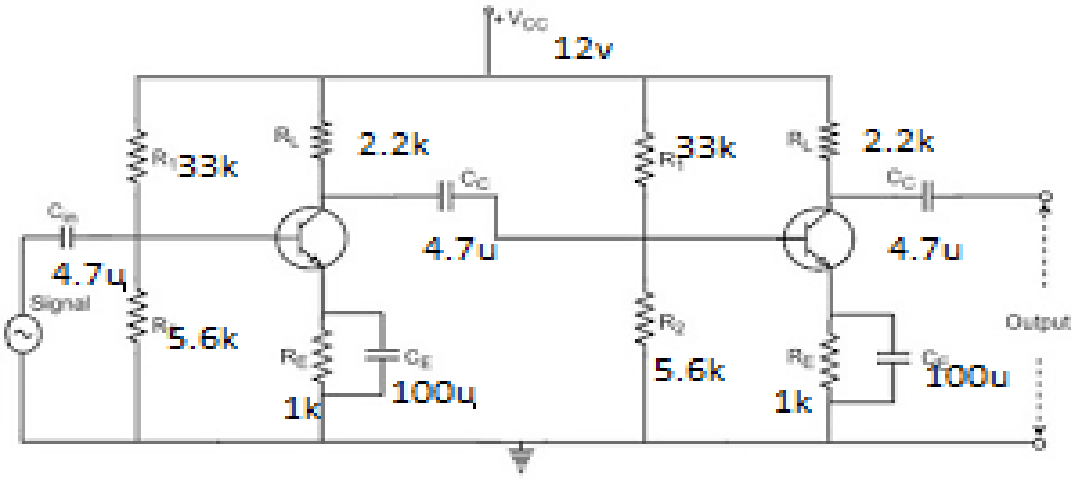
METHODOLOGY 4.8 FREQUENCY RESPONSE OF A RC COUPLED AMPLIFIER

PLOT THE FREQUENCY RESPONSE CHARACTERISTICS OF A RC COUPLED AMPLIFIER

4.8.1 Description:

1. The setup for this experiment requires a standard DC regulated power supply, transistor, carbon resistor, bread board.
2. Standard DC regulated power supply is used to regulate the voltage from 0V to 30V.
3. CRO is connect across output..

4.8.2Circuit Diagram:



4.8.3Theory:

- When ac signal is applied to the base of the first transistor, it appears in the amplified form across its collector load R_C is given to base of next stage through coupling capacitor Cc.
- The second stage does further amplification of the signal. In this way the cascaded (in series) stage will amplify the signal further and overall gain is considerably increased.

Voltage Gain:
The ratio of output voltage to input voltage of a BJT amplifier is known as voltage gain. It is denoted by a letter Av.
Av = Output voltage / Input voltage = Vo/ Vi

Bandwidth:
The range of frequency over which the voltage gain of an amplifier remains constant is known as bandwidth of an amplifier.
It is denoted as bandwidth of an amplifier.

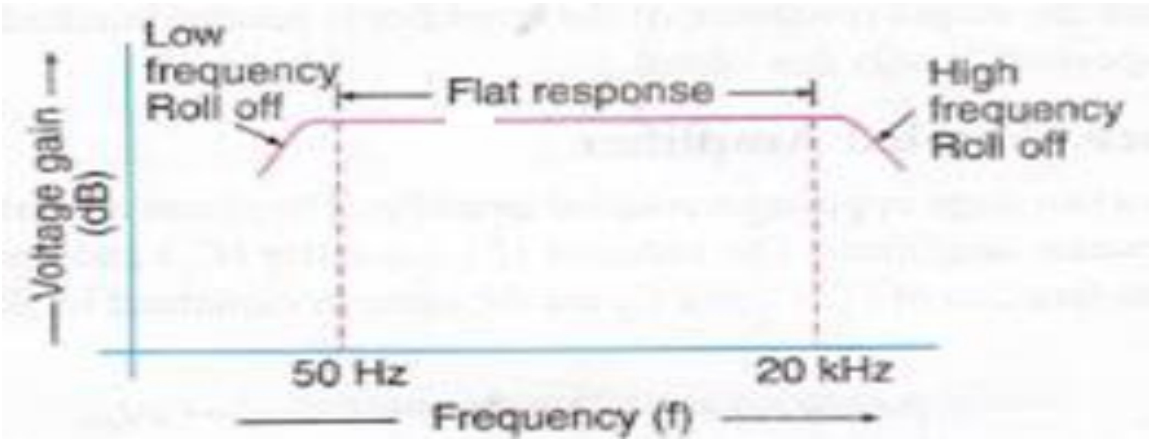
4.8.4 PROCEDURE:

1. First the signal generator is connected directly to the a.c. milli-voltmeter by keeping signal frequency at about 500 Hz.
2. The amplitude (voltage) of the input signal is adjusted to 0.1V or 0.05V. This is the amplifier in put (Vi).
3. Now the signal generator is disconnected from the a.c. milli-voltmeter and connected to the input of the of the amplifier and the a.c. mill voltmeter is connected to the output of the amplifier.
4. Set the input frequency at 10 Hz, note the output voltage (Vo) from the a.c. milli-voltmetern keeping the input voltage, Vi constant. Vary the input frequency 'f' and note the output voltage.
5. The frequency of the input signal is varied in convenient steps i.e. at least 5 values with equal intervals, in each range of frequency in the signal generator, the output voltage Vo is noted in the table for each frequency. Calculate the voltage gain of the amplifier for each value of the frequency, f of the input signal, using the relation, Voltage gain, Vo / Vi.

4.6.4 OBSERVATIONS:

s.no	Frequency(f) Hz	Output voltage(vo)	Vo/vi	20 log vo/vi
1				
2				
3				
4				
5				
6				
7				

4.6.7 Model Graph:



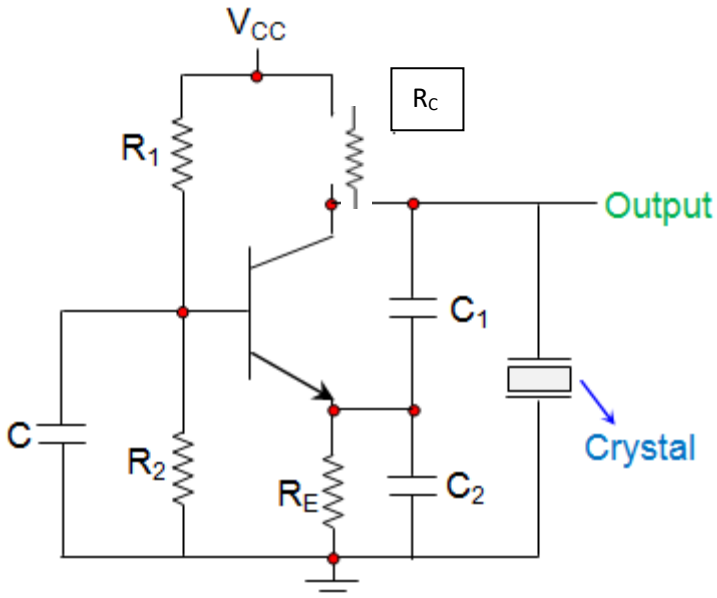
CRYSTAL OSCILLATOR

1. **OBJECTIVE** :
   d) To implement the Crystal oscillator
   e) To verify the effect of varying the tank circuit component values and observe output waveform on CRO.

2. Description:

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	TRANSISTOR	BC107BP	1	For amplification
2	RESISTOR	R_1 =100K ohms R_2 , R_4 =10K ohms R_e = 1K ohms	1 2 1	For biasing and stabilization
3	CRYSTAL		1	For tank circuit
4	CAPACITORS	C_1,C_2 =0.01uf	2	For tank circuit
5	CAPACITORS	Cin, Cout =10uf	2	For in blocking and coupling capacitor
6	CAPACITORS	Ce = 100pf	1	Emitter bypass capacitor
7	CRO	0-20 M HZ	1	For observing the output waveforms
8	BREADBOARD		1	To Develop the circuit
9	CONNECTING WIRES		REQUIRED NUMBER	
10	REGULATED POWERSUPPLY	0-30V	1	To provide biasing

3. Circuit Diagram:



4. Theory :

The tank circuit is made up of Crystal,C1 and C2 . The resistanceR_1 and R_2 provides the necessary biasing. The capacitance C_{in} blocks the D.C component. The frequency of oscillations is determined by the values of L_S,C_S and $C_P$and is given by

$$f_s = \frac{1}{2\pi\sqrt{L_s C_s}} \quad f_p = \frac{1}{2\pi\sqrt{L_S \frac{C_P C_S}{C_P + C_S}}}$$

The tank circuit provides 180^0. And the transistor in CE mode provides another 180^0 phase. The total phase shift from the base of the transistor around the circuit and back to the base will be exactly 360^0 or 0^0 , this satisfies the Barkhausen condition for sustaining oscillations and total loop gain of this circuit is greater than or equal to 1,this condition used to generate the sinusoidal oscillations

5. **PROCEDURE**:

1.**Connect** the circuit as per **circuit diagram**

2. **select** the first set of crystal.

3.**observe** the **output waveform** on the **CRO (sine wave).**

4.**Note down** the **amplitude** and **time period** of the **outputwaveform** from CRO

5. **Calculate** the**theoreticalfrequency** for the given set of crystal using the formula

$$f_s = \frac{1}{2\pi\sqrt{L_s C_s}} \quad f_p = \frac{1}{2\pi\sqrt{L_S \frac{C_P C_S}{C_P + C_S}}}$$

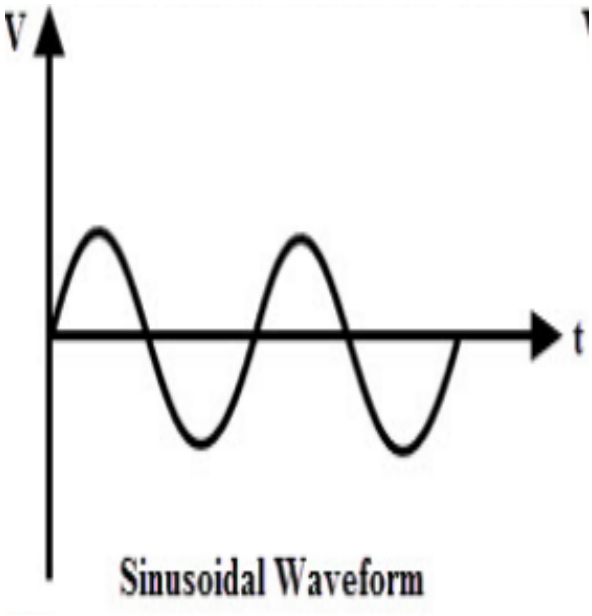
6. **Repeat** the steps from (2) to (5) for the second set of crystal.

7. **Plot** the graph for the output waveform.

6. OBSERVATIONS:

S.NO	crystal	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1				
2				
3				
4				

7. MODEL GRAPH



Sinusoidal Waveform

8. CALCULATIONS:

Theoretical frequency

$$f_s = \frac{1}{2\pi\sqrt{L_s C_s}} \quad f_p = \frac{1}{2\pi\sqrt{L_S \frac{C_P C_S}{C_P + C_S}}}$$

Practical frequency (f_0)=(1/T)

Where Time Period (T) = No. of horizontal divisions x Times/division

Amplitude= No. of vertical divisions x volts/division

9. PRECAUTIONS:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure that the variable capacitors and inductors are properly adjusted
- Ensure the correct position of different knobs on the CRO
- Get the connections checked
- Ensure that there are no loose connections
- Equipment should be handled carefully

B . Safety precautions

- Keep workbench clear by placing extra items(books ,bags etc…) on shelves
- Wear sensible clothing including footwear
- Do not switch on the power supply while making connections

HARTLEY OSCILLATOR

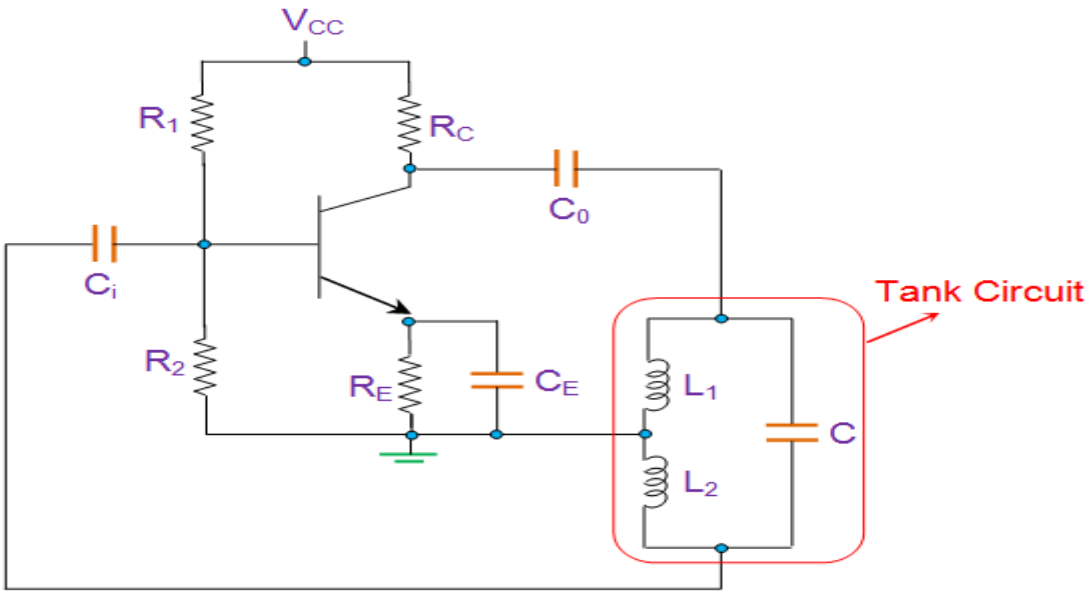
1. OBJECTIVE:

a) To implement the Hartley oscillator
b) To verify the effect of varying the tank circuit component values and observe output waveform on CRO.

2. Description:

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	TRANSISTOR	BC107BP	1	For amplification
2	RESISTOR	R_1 =100K ohms R_2 , R_4 =10K ohms R_e = 1K ohms	1 2 1	For biasing and stabilization
3	INDUCTORS	L_1,L_2 =10mH	2	For tank circuit
4	CAPACITORS	C_1 =0.01uf	1	For tank circuit
5	CAPACITORS	Cin, Cout =10uf	2	For in blocking and coupling capacitor
6	CAPACITORS	Ce = 100pf	1	Emitter bypass capacitor
7	CRO	0-20 M HZ	1	For observing the output waveforms
8	BREADBOARD		1	To Develope the circuit
9	CONNECTING WIRES		REQUIRED NUMBER	
10	REGULATED POWERSUPPLY	0-30V	1	To provide biasing

3.Circuit Diagram:



4. Theory:

The tank circuit is made up of C, L_1 and L_2 .The resistanceR_1 and R_2 provides the necessary biasing. The capacitance C_{in} blocks the D.C component. The frequency of oscillations is determined by the values of C, L_1,L_2 and is given by

$$f_0 = 1/(2\Pi(L_TC)^{1/2})$$

Where $L_T = L_1+L_2$

The tank circuit provides 180^0. And the transistor in CE mode provides another 180^0 phase. The total phase shift from the base of the transistor around the circuit and back to the base will be exactly 360^0 or 0^0 .this satisfies the Barkhausen condition for sustaining oscillations and total loop gain of this circuit is greater than or equal to 1,this condition used to generate the sinusoidal oscillations

5. PROCEDURE:

1. **Connect** the circuit as per **circuit diagram**

2. **Select** the first set of inductors **L1 and L2.**

3.**Observe** the **output waveform** on the **CRO (sine wave).**

4. **Note down** the **amplitude** and **time period** of the **outputwaveform** from CRO

5. **Calculate** the**theoreticalfrequency** for the given set of inductors L_1 and L_2 using the formula

$f_0 = 1/(2\Pi(L_TC)^{1/2})$ Where $L_T = L_1+L_2$

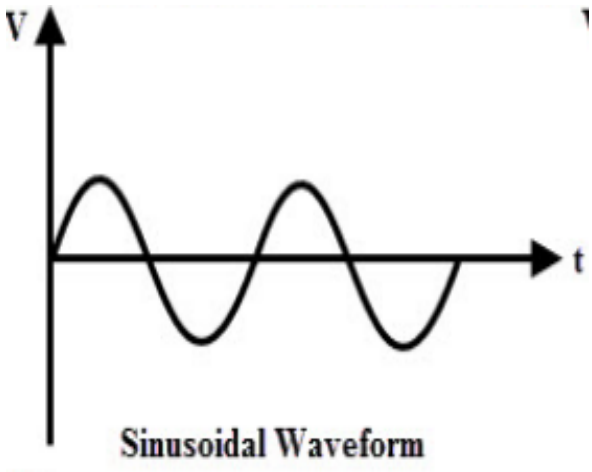
6. **Repeat** the steps from (2) to (5) for the second set of inductors L_1 and L_2.

7. **Plot** the graph for the output waveform.

6. OBSERVATIONS:

S.NO	L1(Henrys)	L2(Henrys)	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1					
2					
3					
4					

7. MODEL GRAPH



Sinusoidal Waveform

8. CALCULATIONS:

Theoretical frequency $f_0 = 1/(2\Pi(L_TC)^{1/2})$ Where $L_T = L_1 + L_2$

Practical frequency (f_0)=(1/T)

Where Time Period (T) = No. of horizontal divisions x Times/division

Amplitude= No. of vertical divisions x volts/division

9. PRECAUTIONS:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure that the variable capacitors and inductors are properly adjusted
- Ensure the correct position of different knobs on the CRO
- Get the connections checked
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions:

- Keep workbench clear by placing extra items(books ,bags etc…) on shelves
- Wear sensible clothing including footwear
- Do not switch on the power supply while making connections

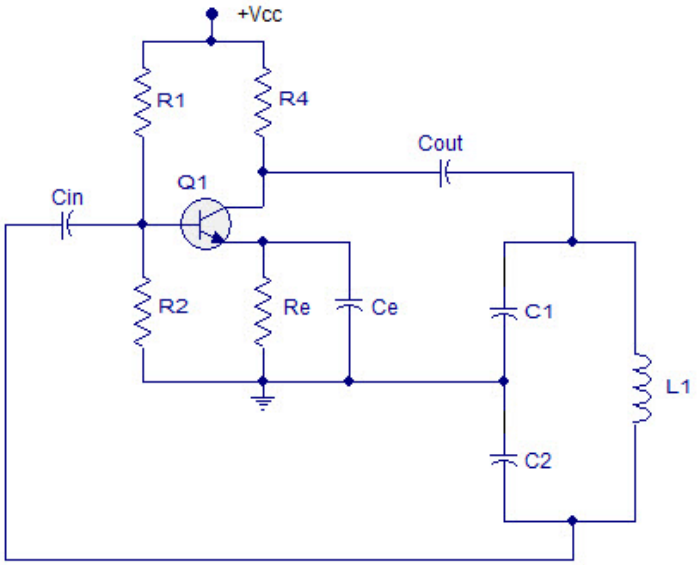
COLPITTS OSCILLATOR

1. Description

The setup for this experiment requires the following equipment

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	TRANSISTOR	BC107BP	1	For amplification
2	RESISTOR	R_1 =100K ohms R_2 , R_4 =10K ohms R_e = 1K ohms	1 2 1	For biasing and stabilization
3	CAPACITORS	C1,C2 =0.1uf	2	For tank circuit
4	CAPACITORS	Cin, Cout =10uf	2	For in blocking and coupling capacitor
5	CAPACITORS	Ce = 100pf	1	Emitter bypass capacitor
6	INDUCTOR	L1 = 2mH	1	For tank circuit
7	CRO	0-20 M HZ	1	For observing the output waveforms
8	BREADBOARD		1	To Develope the circuit
9	CONNECTING WIRES		REQUIRED NUMBER	
10	REGULATED POWERSUPPLY	0-30V	1	To provide biasing

2.Circuit Diagram



3. Theory

The tank circuit is made up of L_1, C_1 and C_2 .The resistanceR_1 and R_2 provides the necessary biasing. The capacitance C_{in} blocks the D.C component. The frequency of oscillations is determined by the values of L_1, C_1 and C_2 and is given by

$$f_0=1/(2\pi(C_T\ L_1)^{1/2})$$

where $C_T=C_1C_1/(C_{1+}C_2)$

The tank circuit provides 180^0. And the transistor in CE mode provides another 180^0 phase. The total phase shift from the base of the transistor around the circuit and back to the base will be exactly 360^0 or 0^0 .this satisfies the Barkhausen condition for sustaining oscillations and total loop gain of this circuit is greater than or equal to 1,this condition used to generate the sinusoidal oscillations

4. Procedure

1.**Connect** the circuit as per **circuit diagram**

2. **Select** the first set of capacitors **C_1 and C_2**

3.**observe** the **output waveform** on the **CRO (sine wave).**

4.**Note down** the **amplitude** and **time period** of the **outputwaveform** from CRO

5. **Calculate** the**theoreticalfrequency** for the given set of capacitors C_1 and C_2 using the formula **$f_0 = 1/(2\Pi(LC_T)^{1/2})$**

Where $C_T = (C_1\times C_2)/(C_1+C_2)$.

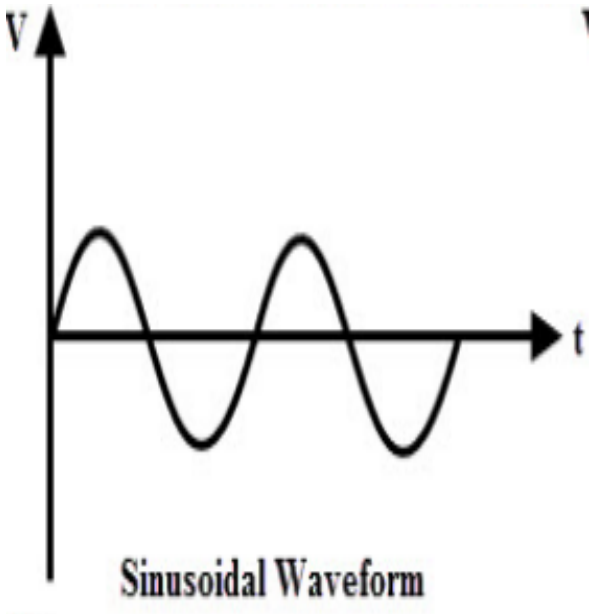
6. **Repeat** the steps from (2) to (5) for the second set of capacitors C_1 and C_2

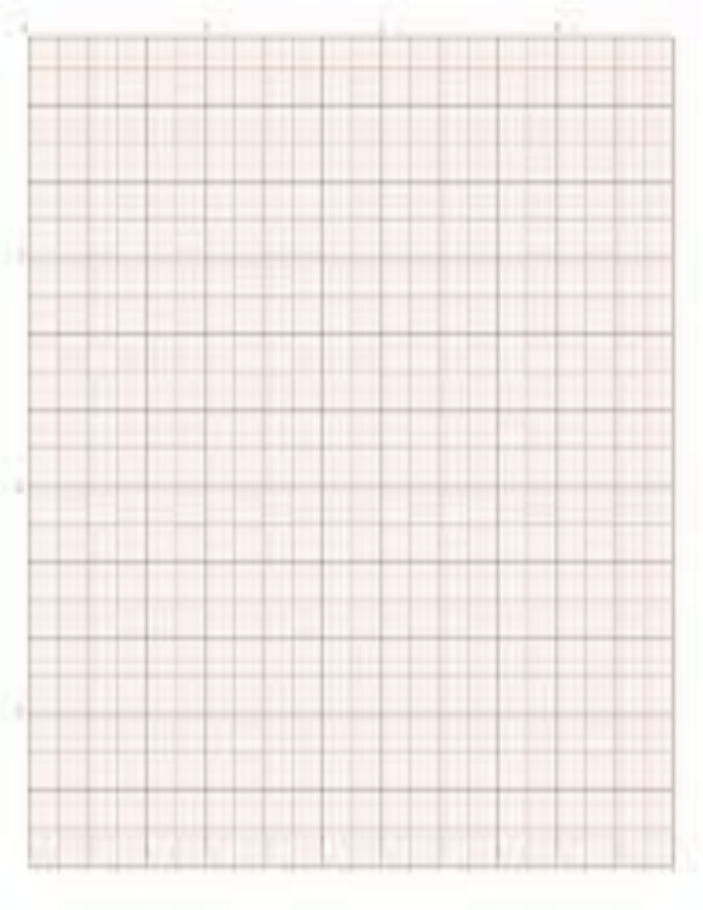
7. **Plot** the graph for the output waveform.

5.Observations:

S.NO	C_1 (farads)	C_2 (farads)	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1					
2					
3					
4					

6.Graph





7. Calculations

Theoretical frequency (f_0)= $1/(2\Pi(LC_T)^{1/2})$

Where $C_T = (C_1 \times C_2)/(C_1+C_2)$.

Practical frequency (f_0)=(1/T)

Where Time Period (T) = No. of horizontal divisions x Times/division

Amplitude= No. of vertical divisions x volts/division

8.Precautions

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure that the variable capacitors and inductors are properly adjusted
- Ensure the correct position of different knobs on the CRO
- Get the connections checked
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions

- Keep workbench clear by placing extra items(books ,bags etc…) on shelves
- Wear sensible clothing including footwear
- Do not switch on the power supply while making connections

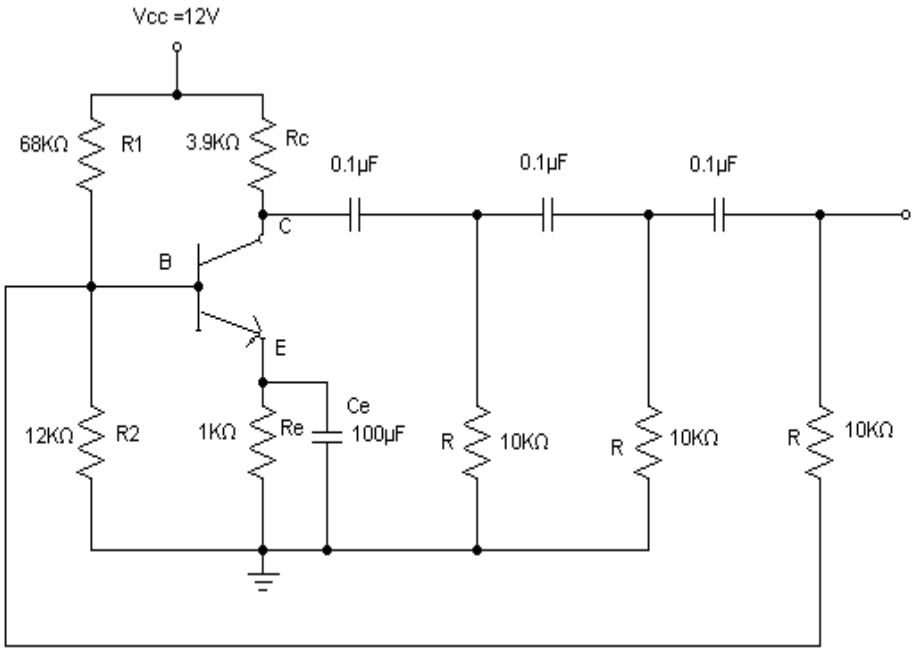
RC PHASE SHIFT OSCILLATOR

1. Description

The setup for this experiment requires the following equipment

S.NO	NAME OF THE EQUIPMENT	RANGE	QUANTITY	PURPOSE
1	Transistor	BC 147	1	Used as an amplifier in CE mode
2	Resistors	3.9kΩ,12kΩ,68kΩ 1kΩ	one from each	Biasing and stabilization
3	Resistor	10kΩ	3	Used for feed back
4	Capacitors	100μF	1	To bypass the current
5	Capacitor	0.01or 0.1 μF	3	For feed back
6	CRO	0-20MHz	1	To display the waveforms
7	RPS	0-30V	1	To supply the required voltage
8	Bread board		**1**	To connect components
9	Connecting wires			To make connections and interconnections to equipment

2. Circuit Diagram



3. Theory

An oscillator is an electronic circuit for generating an AC signal voltage with a DC supply as the only input requirement. The frequency of the generated signal is decided by the circuit elements used. An oscillator requires an amplifier, a frequency selective network and a positive feedback from the output to the input. The oscillators are basically classified as Sinusoidal and non sinusoidal oscillators.

The Barkhausen criterion for sustained oscillation is $A\beta = 1$ where A is the gain of the amplifier and β is the feedback factor (gain).The unity gain means signal is in phase. (If the signal is 180 out of phase and gain will be -1). RC-Phase shift Oscillator has a CE amplifier followed by three sections of RC phase shift feed-back Networks. The output of the last stage is return to the input of the amplifier. The values of R and C are chosen such that the phase shift of each RC section is 60º.Thus The RC ladder network produces a total phase shift of 180º between its input and output voltage for the given frequency. Since CE Amplifier produces 180 º phases shift. The total phase shift from the base of the transistor around the circuit and back to the base will be exactly 360º or 0º. This satisfies the Barkhausen condition for sustaining oscillations and total loop gain of this circuit is greater than or equal to 1, this condition used to generate the sinusoidal oscillations.

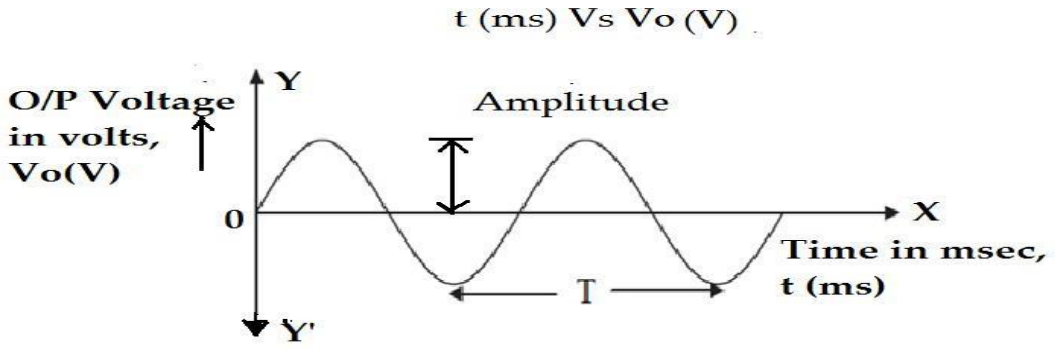
4. Procedure

1. **Identify** the **pin** details of BC107 Transistor.
2. **Test** it using **a Multimeter**
3. **Set** up the **component**s on **breadboard** as per the circuit..
4. **Make** the **connections** as per the **circuit diagram**
5. **Supply** a **DC** voltage of **12** v by using Regulated power supply
6. **Connect CRO** probes at the **collector** of the Transistor.
7. **Observe** the **output** wave form on **CRO**
8. **Measure** the **time period** and **voltage** of the output wave .
9. **Plot** the output waveform on a **graph** sheet.

5. Observations

S. No	Resistance value	Capacitance value	Amplitude	Time period	Frequency

6.Graph



7. Calculations: Use the following formulae to calculate the frequency

$$f = \frac{1}{2\pi(\sqrt{6})CR}$$

8. Precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure that the variable resistor is properly adjusted
- Ensure the correct position of different knobs on the CRO
- Get the connections checked by the concerned staff member
- Ensure that there are no loose connections
- Equipment should be handled carefully
- Keep workbench clear by placing extra items(books ,bags etc…) on shelves
- Wear sensible clothing including footwear
- Do not switch on the power supply while making connections

HALF WAVE RECTIFIER SIMULATION

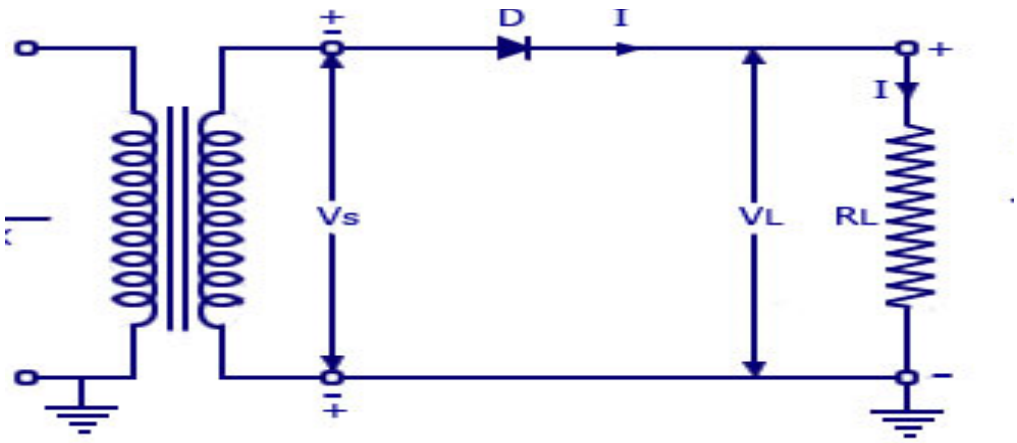
1. Description

The setup for this experiment requires the following equipment

Name	Specifications/ Range	No	Purpose
Step-down transformer	230v/9-0-9 V	1	To step down the A.C voltage
Diode	IN4007	1	To rectify the ac
Resistor	1K ohms	1	Load resistor.
C.R.O	Dual channel	1	To display the wave forms
Function generator	230V, 50 Hz	1	To give AC input
Connecting Wires		As per need	To make connections

2. Circuit Diagram

Halfwave rectifier:



3. Theory

A rectifier is a circuit, which converts AC into DC . When the AC voltage is applied to the Half wave rectifier. During positive half cycle the diode becomes forward biased and conducts the current .hence the current flows through the load resistor.

During negative half cycle the diode becomes reverse biased and does not conducts the current .hence no current flows through the load resistor. So only positive half cycles will appear in the output and negative half cycles are clipped.

Ripple factor can be calculated by using the formula

Ripple factor=Vac/ Vdc

Percentage of regulation can be calculated by using the formula

Percentage of regulation = (V nl – Vfl) / V fl *100

4. Procedure.

1.Open PSPICE schematic**.**

2.Create a new file.

3.Get the required **components/devices** from the **library.**

4.Place the components/devicein the **work space.**

5. Setthe component/devices **values** according to the circuit.

6.Make the **connections** as per the circuit diagram.

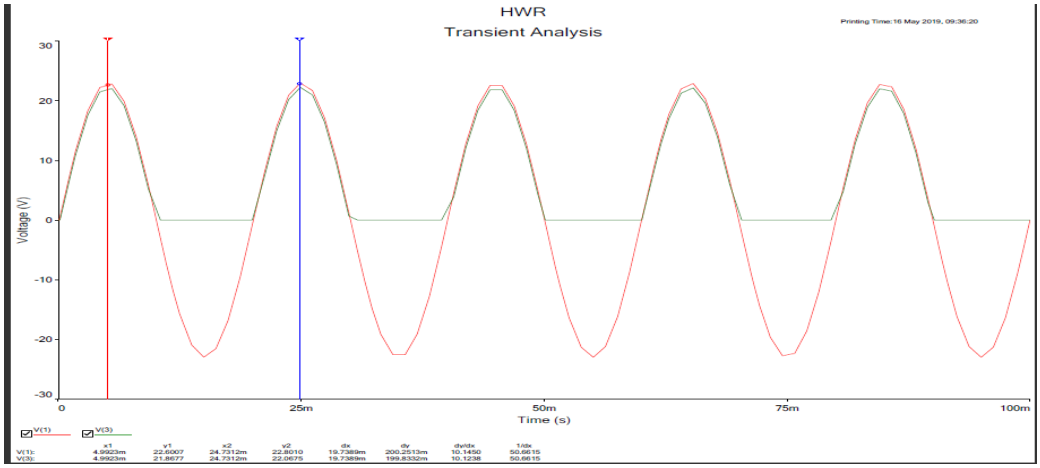
7.Save the circuit**.**

8.Apply AC voltageto the **transformer.**

9.Setup the **transient analysis** and **Run** the **simulation**

10. Observe the **output wave forms.**

5. Model Graph



Precautions

- The primary and secondary of the transformer should be correct values.
- The polarities of the diode should be carefully connected.
- Connect the circuit as per circuit diagram.
- Get the connections checked by the concerned staff member.
- Ensure whether selected the correct analysis in setup.

FULL WAVE RECTIFIER SIMULATION

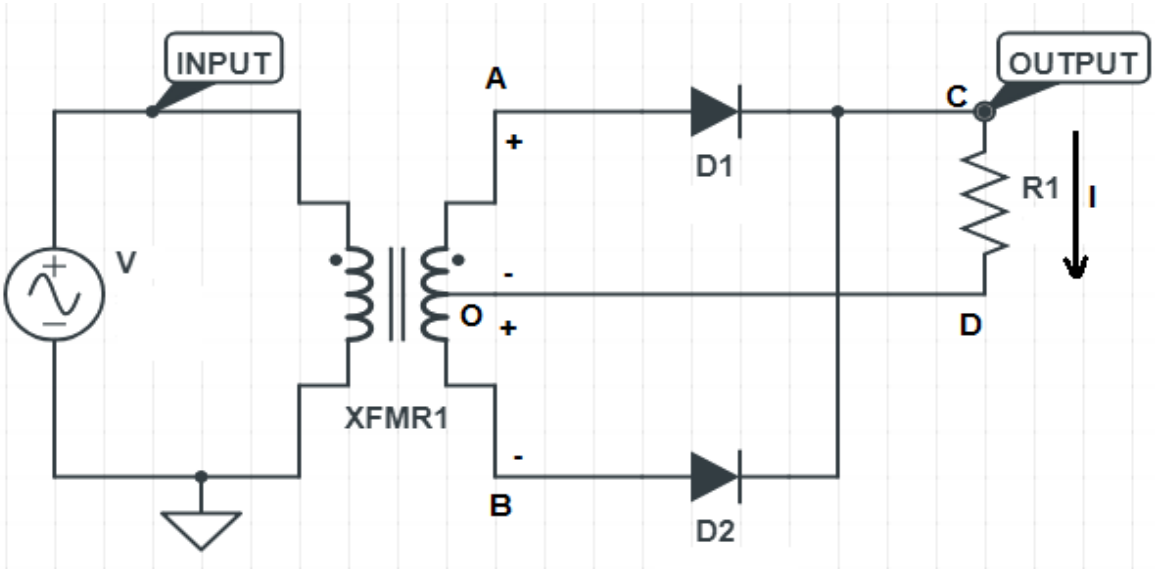
1. Description

The setup for this experiment requires the following equipment

Name	Specifications/ Range	No	Purpose
Step-down transformer	230/9-0-9 V, center tapped	1	To step down the A.C voltage
Diode	IN4007	2	To rectify the ac
Resistor	1Kohms	1	Load resistor
C.R.O	Dual channel	1	To display the wave forms
Function generator	230V, 50 Hz	1	To give AC input
Connecting Wires		As per need	To make connections

2. Circuit Diagram

Halfwave rectifier:



3.Theory

The conversion of AC into pulsating DC is called Rectification. Electronic Devices can convert AC power into DC power with high efficiency.

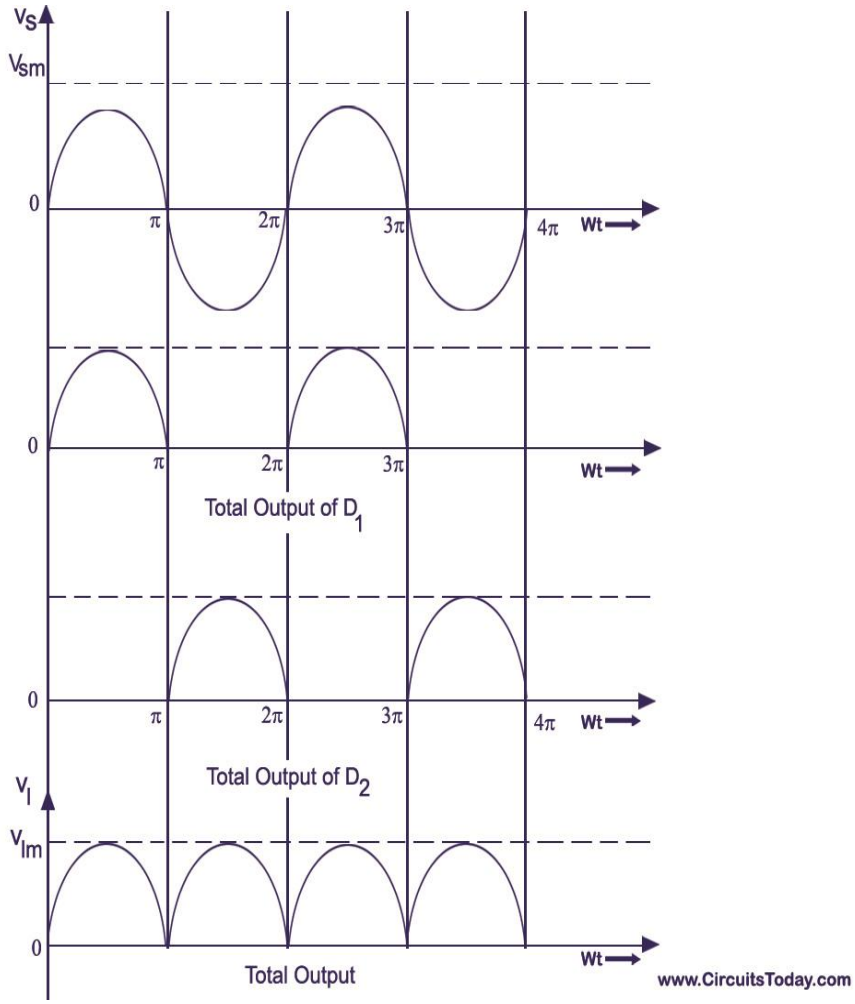
The full-wave rectifier consists of a center-tapped transformer, which results in equal voltages above and below the center-tap. During the positive half cycle, a positive voltage appears at the anode of D1 while a negative voltage appears at the anode of D2. Due to this diode D1 is forward biased. It results a current Id1 through the load R.

During the negative half cycle, a positive voltage appears at the anode of D2 and hence it is forward biased, resulting a current Id2 through the load. At the same instant a negative voltage appears at the anode of D1, reverse biasing it and hence it doesn't conduct.

4. Procedure.

1. **Open** PSPICE schematic**.**
2. **Create** a new file.
3. **Get** the required **components/devices** from the **library.**
4. **Place** the components/devicein the **work space.**
5. **Set**the component/devices **values** according to the circuit.
6. **Make** the **connections** as per the circuit diagram.
7. **Save** the circuit**.**
8. **Apply AC** voltageto the **transformer.**
9. **setup**the **transient analysis** and **Run** the **simulation.**
10. **Observe** the **output wave** forms .

5. Model Graph



6.Precautions

- The primary and secondary of the transformer should be correct values.
- The polarities of the diode should be carefully connected.
- Connect the circuit as per circuit diagram.
- Get the connections checked by the concerned staff member.
- Ensure whether selected the correct analysis in setup.

ZENER VOLTAGE REGULATOR

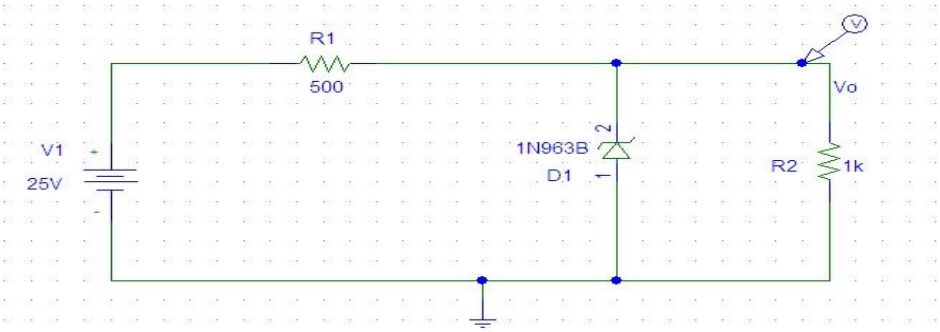
1. Description

The setup for this experiment requires the following equipment

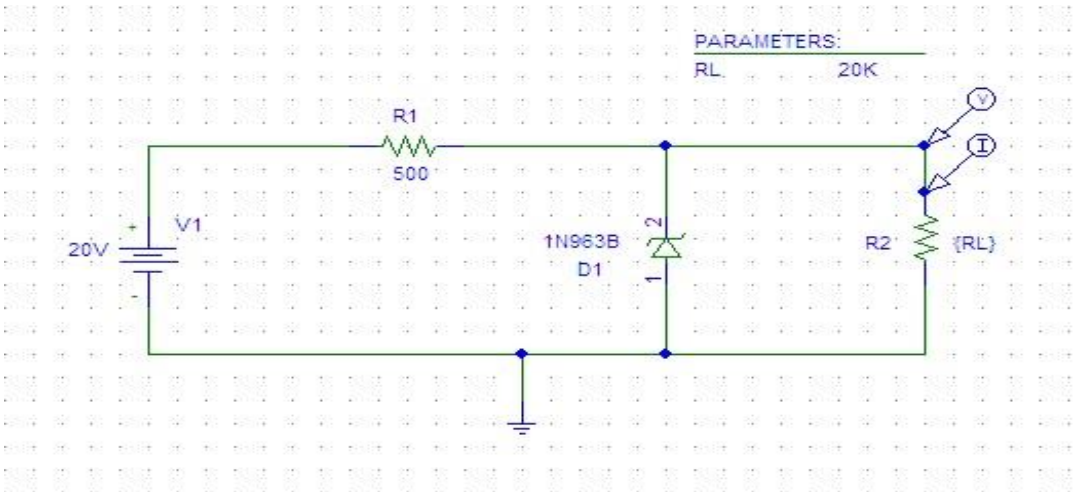
Name	Specification/Range	No	Purpose
PSPICE schematic	-	-	To Simulate the zener voltage regulator
Zener diode	1N963B / 12V	1	To get constant voltage in reverse bias after breakdown
Resistor	500Ω	1	To drop excessive voltage.
Resistor	1K	1	Load resistor
Variable Resistor	50Ω-20K	1	Variable load
Voltage marker	-	2	To monitor the input/output voltages
Current marker	-	1	To monitor load current
wire	-	-	To make connections.
Vdc	0-30V	1	To provide biasing voltage.

2. Circuit Diagram

Line regulation:



Load regulation:



3.Theory:

The function of a regulator is to provide a constant output voltage to a load connected in parallel with it in spite of the ripples in the supply voltage or the variation in the load current and the zener diode will continue to regulate the voltage until the diodes current falls below the minimum $I_{Z(min)}$ value in the reverse breakdown region. It permits current to flow in the forward direction as normal, but will also allow it to flow in the reverse direction when the voltage is above a certain value - the breakdown voltage known as the Zener voltage. The Zener diode specially made to have a reverse voltage breakdown at a specific voltage. Its characteristics are otherwise very similar to common diodes. In breakdown the voltage across the Zener diode is close to constant over a wide range of currents thus making it useful as a shunt voltage regulator.

a) Line Regulation

In this type of 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 =

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 =

=No load voltage/Load voltage when the load current is minimum.

=Full load voltage/load voltage when the load current is maximum.

4.Procedure:

A. Line regulation:

1.Open PSPICE schematic**.**

2.Create a new file.

3.Get the required **components/devices** from the **library.**

4.Place the components/devicein the **work space.**

5.Change the component/devices **values** according to the circuit.

6.Make the **connections**as per the circuit diagram.

7.Save the circuit**.**

8.Setup the **DC sweep** analysis **(vary** the input voltage from **0-25V)**

9.Simulate/run the **circuit** and **observe** the **plot.**

B. Load regulation:

1.Open PSPICE schematic.

2.Create a new file.

3.Get the required **components/devices** from the **library.**

4.Place the components/devices in the **work space.**

5.Change the component/device **values** according to the circuit.

6.Make the **connections**as per the circuit diagram**.**

7.Model the **load resistor** with the help of **PARAM part.**

8.savethe circuit.

9.Setup the **DC sweep** analysis.

10.Take the load resistor as **global parameter (vary** the load resistor from **50Ω to 20KΩ).**

11.Simulate/run the **circuit** and **observe** the **plot.**

5.Observations:

Zener breakdown voltage(Vz)= in volts.

Zener breakdown voltage Vz = in volts.

Line characteristics:-

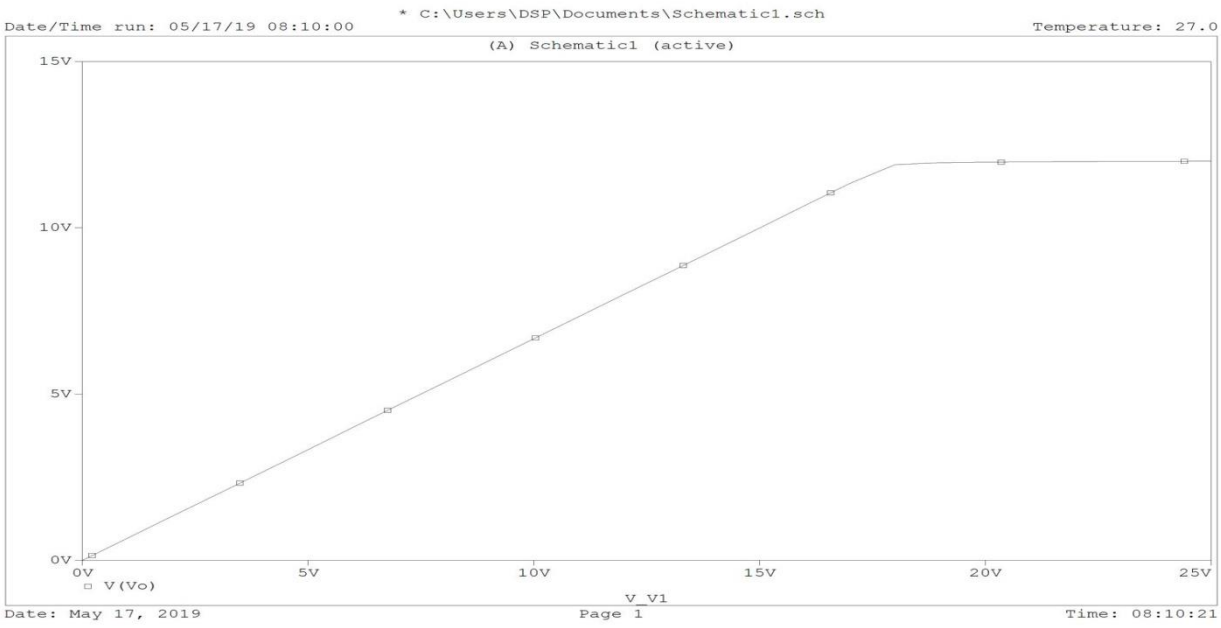
S.NO	ZENER VOLTAGE(V_Z)	ZENER CURRENT(I_Z)

Load characteristics:-

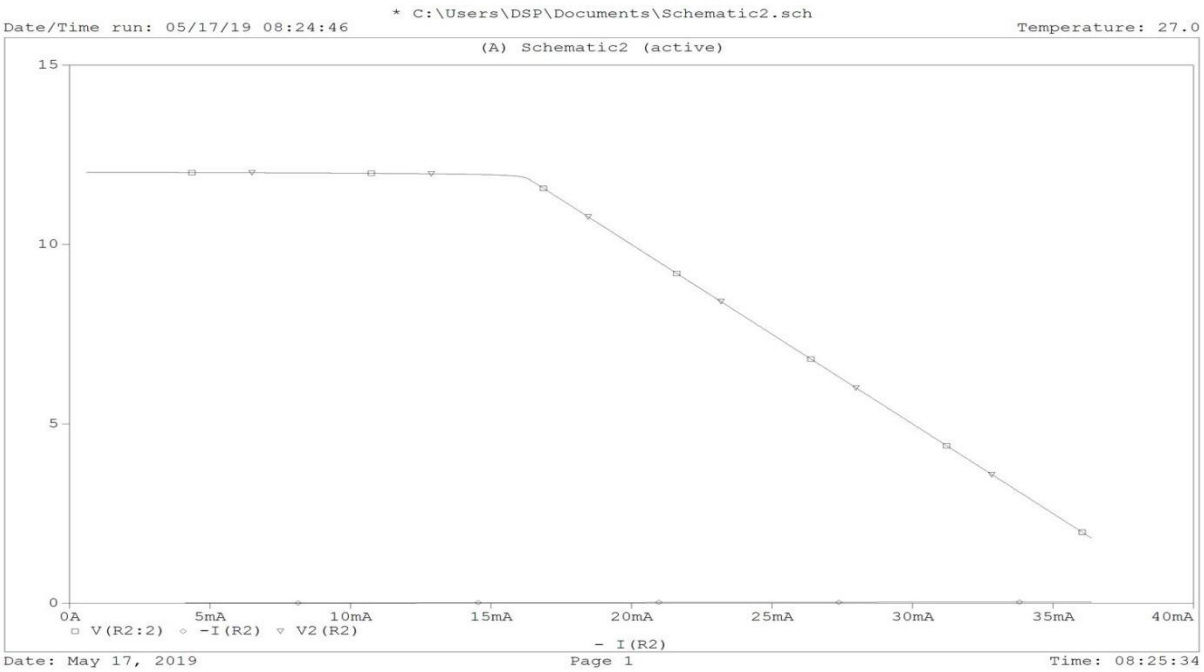
S. No	V_{NL}(VOLTS)	V_{FL} (VOLTS)	R_L (KΩ)	% REGULATION

6.Graph

A.Line regulation:



B. Load regulation:



7.Theoritical calculations: When selecting the zener diode, be sure that its maximum power rating is not exceeded.

I_{max} = Maximum current for Zener diode

V_Z =Zener diode standard voltage
V_{IN}= Input voltage
V_S=voltage across series resistor..
V_L=voltage across load resistor.
I_S= current passing through series resiastor
I_Z= current passing through Zener diode
I_L= current passing through Load resiastor

Calculating voltage and current

The total current drawn from the source is the same as that through the series resistor

The current through the load resistor is

and the zener diode current is

If the voltage source is greater than Vz

If the voltage source is less than Vz

8.Precautions

1. Ensure correct values of resistors.
2. Ensure the correct input voltage while doing load regulation.
3. Connecting the circuit as per the circuit diagram.4
4. Get the connections checked by the concerned staff member.
5. Ensure whether selected the correct analysis in setup.

CE AMPLIFIER

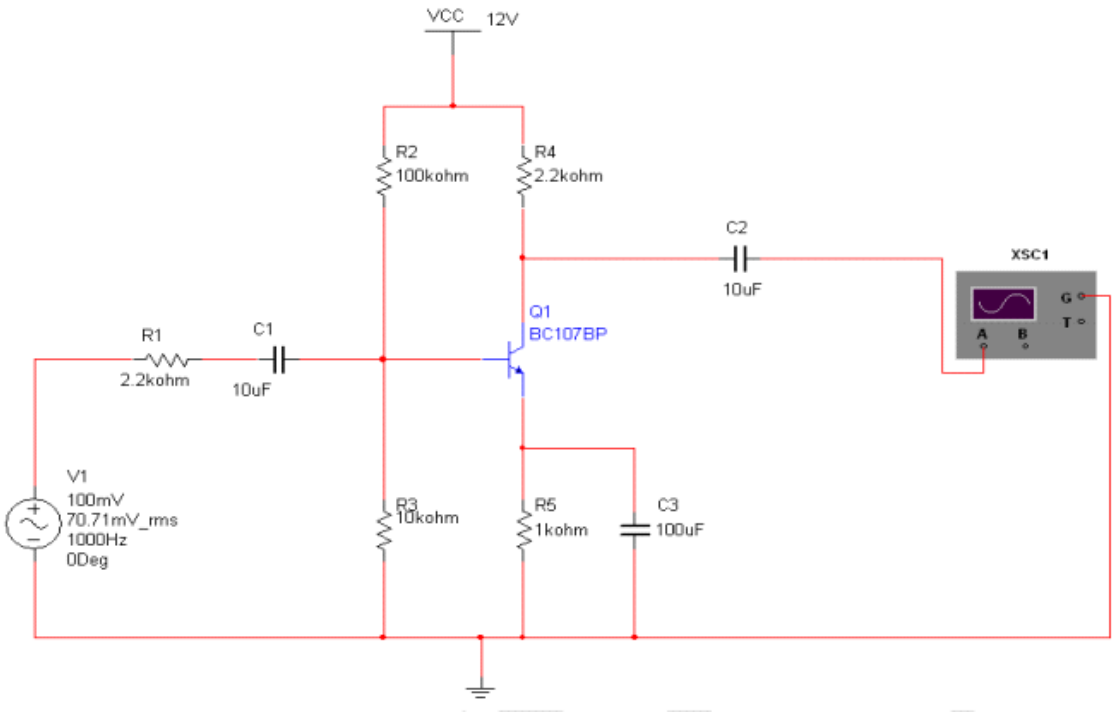
1. Description

The setup for this experiment requires the following

a) PSPICE SOFTWARE

b) Personal computer

2. Circuit Diagram:



3. Theory

When a signal is applied across the emitter-base junction, the forward bias across this junction increases during the upper half cycle. This leads to increase the flow of electrons from the emitter to a collector through the base, hence increases the collector current. The increasing collector current makes more voltage drops across the collector load resistor R4.

The negative half cycle decreases the forward bias voltage across the emitter-base junction. The decreasing collector-base voltage decreases the collector current in the whole collector resistor Rc. Thus, the amplified load resistor appears across the collector resistor

An Emitter bypass capacitor C3 is used parallel with RE to provide a low reactance path to the amplified AC signal. If it is not used, then the amplified AC signal following through RE will cause a voltage drop across it, thereby dropping the output voltage.

4. Procedure

1. **Open** PSPICE schematic**.**
2. **Create** a new file.
3. **Get** the required **components/devices** from the **library.**
4. **Place** the components/devicein the **work space.**
5. **Change** the component/devices **values** according to the circuit.
6. **Make** the **connections** as per the circuit diagram.
7. **Save** the circuit**.**
8. **Select** the Transient analysis in the setup.
9. **Enter** start time and stop time in the analysis parameters.
10. **To check the output** adds Voltage and Current markers.
11. **Simulate** and observe the output.

5. Observations

Input wave:

Amplitude:

Time period:

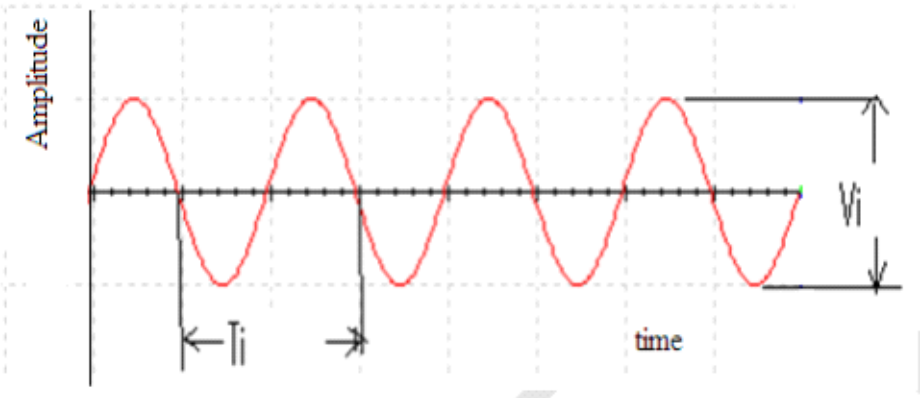
Frequency:

Output wave:

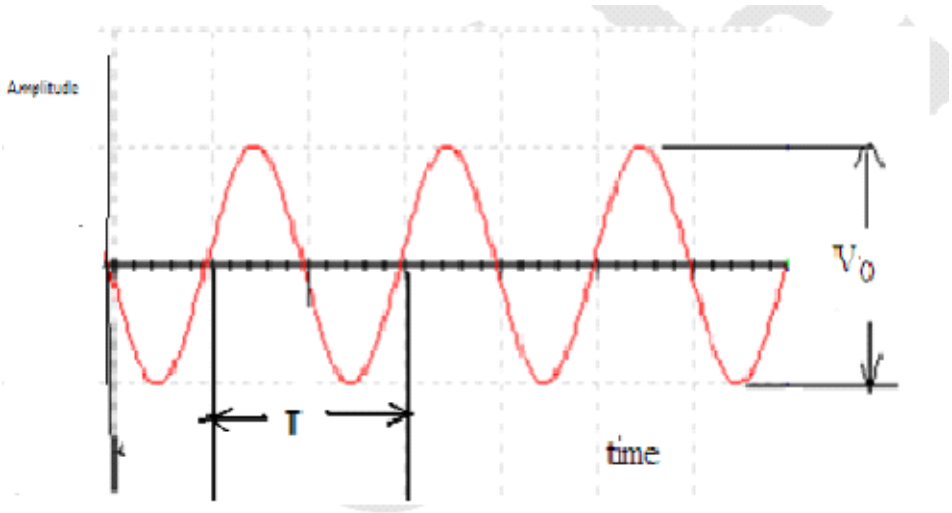
	With bypass	without bypass
Amplitude		
Time period:		
Frequency		

6. Graphs

Input waveform:



Output waveform:



7. Precautions:

1. Ensure correct values of resistors.
2. Ensure the correct input voltage.
3. Connecting the circuit as per the circuit diagram.
4. Get the connections checked by the concerned staff member.
5. Ensure whether selected the correct analysis in setup

SIMULATION OF RC PHASE SHIFT OSCILLATOR

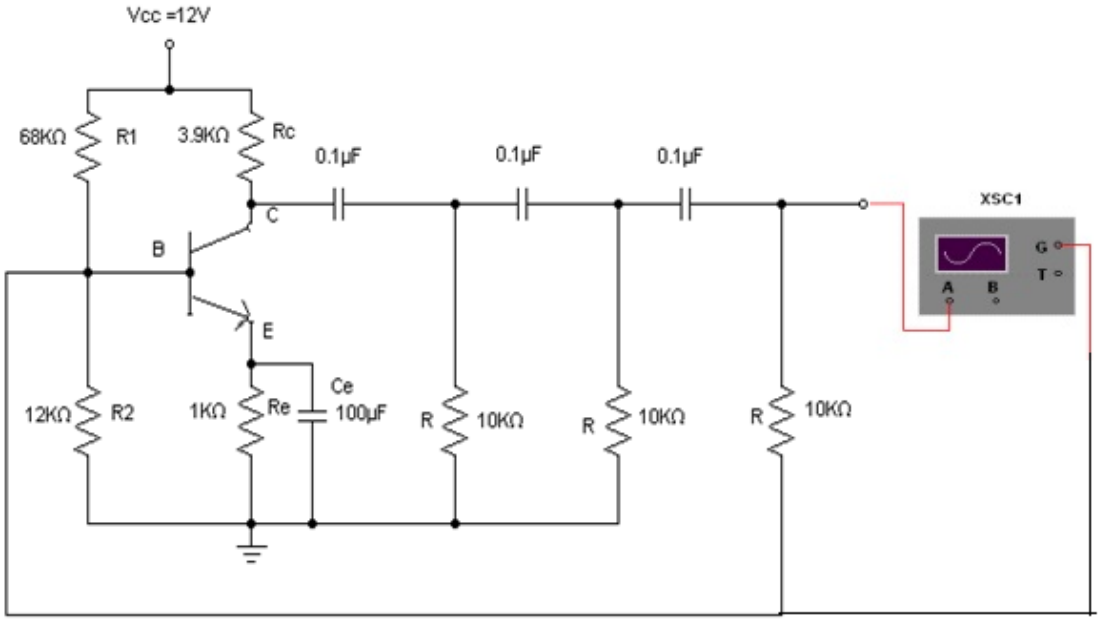
1. Description

The setup for this experiment requires the following

a) PSPICE SOFTWARE

b) Personal computer

2. Circuit Diagram:



3. Theory

An oscillator is an electronic circuit for generating an AC signal voltage with a DC supply as the only input requirement. The frequency of the generated signal is decided by the circuit elements used. An oscillator requires an amplifier, a frequency selective network and a positive feedback from the output to the input. The oscillators are basically classified as Sinusoidal and non sinusoidal oscillators.

The Barkhausen criterion for sustained oscillation is Aβ = 1 where A is the gain of the amplifier and β is the feedback factor (gain).The unity gain means signal is in phase. (If the signal is 180 out of phase and gain will be -1). RC-Phase shift Oscillator has a CE amplifier followed by three sections of RC phase shift feed-back Networks. The output of the last stage is return to the input of the amplifier. The values of R and C are chosen such that the phase shift of each RC section is 60º.Thus The RC ladder network produces a total phase shift of 180º between its input and output voltage for the given frequency. Since CE Amplifier

produces 180 º phases shift. The total phase shift from the base of the transistor around the circuit and back to the base will be exactly 360º or 0º. This satisfies the Barkhausen condition for sustaining oscillations and total loop gain of this circuit is greater than or equal to 1, this condition used to generate the sinusoidal oscillations.

4. Procedure

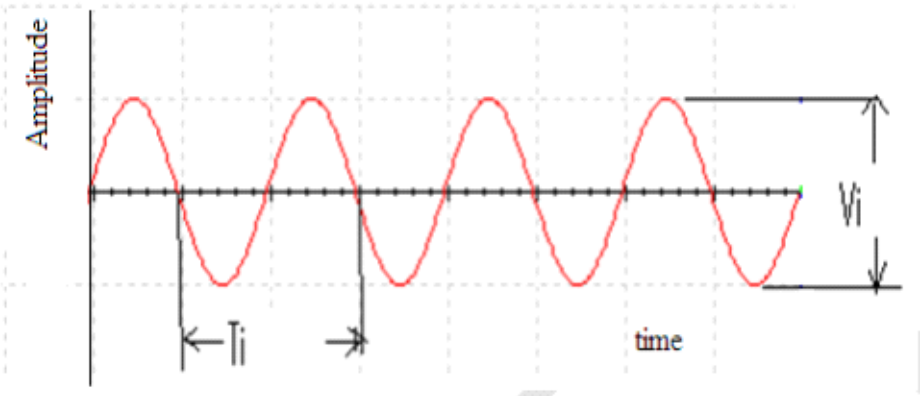
1. **Open** PSPICE schematic**.**
2. **Create** a new file.
3. **Get** the required **components/devices** from the **library.**
4. **Place** the components/devicein the **work space.**
5. **Change** the component/devices **values** according to the circuit.
6. **Make** the **connections** as per the circuit diagram.
7. **Save** the circuit**.**
8. **Select** the Transient analysis in the setup.
9. **Enter** start time and stop time in the analysis parameters.
10. **To check the output,** add Voltage marker and CRO.
11. **Simulate** and observe the output.
12. **Change** the R & C values, repeat steps 7 to 11.
13. Tabulate the readings and observe the effect of R and C on frequency.

5. Observations

S.NO	C (µF)	R (ohms)	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1					
2					
3					
4					

6. Graphs

Generated waveform with R_1C_1:



7. Precautions:

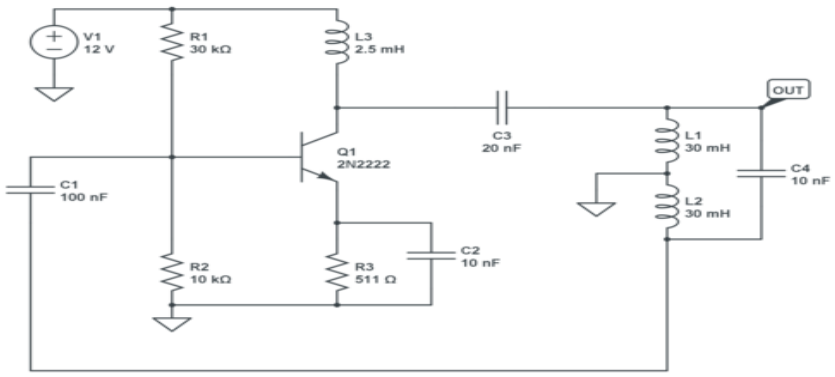
1. Ensure correct values of resistors.
2. Ensure the correct input voltage.
3. Connecting the circuit as per the circuit diagram.
4. Get the connections checked by the concerned staff member.
5. Ensure whether selected the correct analysis in setup

HARTLEY OSCILLATOR CIRCUIT SIMULATION

Description:

S.NO	NAME OF THE COMPONENT	RANGE	QUANTITY	PURPOSE
1	TRANSISTOR	2N2222	1	For amplification
2	RESISTOR	R_1 =30K ohms R_2 =10K ohms R_3 = 511 ohms	1 1 1	For biasing and stabilization
3	CAPACITOR	C_4 = 10 nf	1	For tank circuit
4	CAPACITORS	C_1=100 nf, C_2=10nf	1 1	For in blocking and coupling capacitor
5	CAPACITOR	C_3 =20nf	1	Emitter bypass capacitor
6	INDUCTOR	L_3= 2.5 mH	1	For Coupling
7	INDUCTORS	L_1,L_2= 30 mH	1	For tank circuit
8	CRO	0-20 M HZ	1	For observing the output waveforms
9	BREADBOARD		1	To Develop the circuit
9	CONNECTING WIRES		REQUIRED NUMBER	
10	REGULATED POWERSUPPLY	0-30V	1	To provide biasing
11	DESKTOP PC With MULTISIM Software	PC With latest configuration and specifications	1	For Simulation

2. Circuit Diagram:



3. Theory:

The tank circuit is made up of C_1, L_1 and L_2 .The resistanceR_1 and R_2 provides the necessary biasing. The capacitance C_{in} blocks the D.C component. The frequency of oscillations is determined by the values of C_1, L_1 and L_2 and is given by

$$f_0 = 1/(2\pi(L_T\ C_1)^{1/2})$$

Where $L_T = (L_1 + L_2)$

The tank circuit provides 180^0. And the transistor in CE mode provides another 180^0 phase. The total phase shift from the base of the transistor around the circuit and back to the base will be exactly 360^0 or 0^0 .this satisfies the Barkhausen condition for sustaining oscillations and total loop gain of this circuit is greater than or equal to 1,this condition used to generate the sinusoidal oscillations

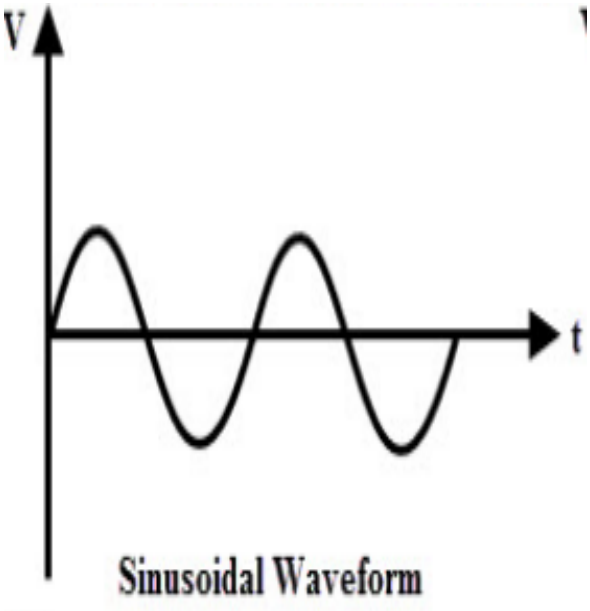
4. PROCEDURE:

1. Open Multisim Software to
2. Select and drag the required components from the library
3. Set appropriate values
4. Make the connections according to the circuit diagram
5. Run the simulation
6. Observe the output waveform and note down the output amplitude and time period (Td).
7. Calculate the frequency of oscillations theoretically and verify it practically (f=1/Td).
8. **Plot** the graph for the output waveform.

5.OBSERVATIONS

S.NO	C (μF)	L_1 (Henry)	L_2 (Henry)	Time period(sec)	Frequency(Hz)	Amplitude(volts)
1						
2						
3						
4						

6. GRAPH



7. CALCULATIONS:

Theoretical frequency (f_0)= $1/(2\Pi (CL_T)^{1/2})$

Where $L_T = (L_1+L_2)$.

Practical frequency (f_0)=(1/T)

Where Time Period (T) = No. of horizontal divisions x Times/division

Amplitude= No. of vertical divisions x volts/division

8. PRECAUTIONS:

A. Procedural precautions

- Disconnect all the equipment from mains before making connections
- Connect the circuit as per the circuit diagram
- Ensure that the variable capacitors and inductors are properly adjusted
- Ensure the correct position of different knobs on the CRO
- Get the connections checked
- Ensure that there are no loose connections
- Equipment should be handled carefully

B. Safety precautions

- Keep workbench clear by placing extra items(books ,bags etc…) on shelves
- Wear sensible clothing including footwear
- Do not switch on the power supply while making connections

UNIT TEST –I

Model Question Paper (C-20)

EC-307 Electronic Circuits - I Lab

TIME: 3 hours Total Marks: 60

Instructions: (1) Any one full question of the following shall be allotted to the students on lottery basis.
(2) All the questions are competency based and are for assessing the candidate's psychomotor skills
(3) Underpinning knowledge shall be assessed through viva voce -6 M

1. A. Draw the circuit diagram of Half wave rectifier. 6M (CO1)

   B. Connect the IC regulator circuit to get a constant voltage of +5V. 18 M (CO1)

   C. Observe and note down the frequency response characteristics of a RC coupled amplifier. 30M (CO2)

2. A. Identify the terminals of IC 7912. 6M (CO1)

   B. Connect a rectifier circuit to get a ripple factor of 1.21 18M (CO1)

   C. Observe and note down Frequency response characteristics of a transformer coupled CE amplifier. 30M (CO2)

3. A. Draw the circuit diagram of RC coupled amplifier. 6M (CO2)

. B. Connect the circuit diagram of Bridge rectifier. 18M (CO1)

   C. Obtain the voltage regulation characteristics of Zener regulator with varying loads. 30M (CO1)

4. A. Draw the circuit diagram of Zener regulator for load regulation. 6M (CO1)

   B. Connect the circuit to get uniform frequency response in audio frequency range. 18M (CO2)

   C. Observe and note down ripple voltage of a bridge rectifier at different loads. 30M (C01)

UNIT TEST –II

Model Question Paper (C-20)

EC-307 Electronic Circuits –I Lab

TIME: 3 hours Total Marks: 60

Instructions: (1) Any one full question of the following shall be allotted to the students on Lottery

(2) All the questions are competency based and are for assessing the Candidate psychomotor skills

(3) Underpinning knowledge shall be assessed through viva voce 6M

1. A. Draw the circuit diagram of Hartley oscillator 6M (CO3)
   B. Connect the circuit diagram of HWR using PSPICE software. 18M (CO4)
   C. Observe and note down the effect of varying the RC component value on frequency response of RC phase shift oscillator using PSPICE software 30M (CO4)

2. A. Draw the circuit diagram of Zener regulator for load regulation. 6M (CO4)
   B. Connect the RC phase shift oscillator to generate sustained oscillations using PSPICE software. 18M (CO4)
   C. Obtain the output waveform of Hartley oscillator using PSPICE software. 30M (CO4)

3. A. Identify the required components to implement RC phase shift oscillator. 6M (CO3)
   B. Connect the circuit diagram of Zener regulator for line regulation using PSPICE software 18M (CO4)
   C. Observe and notedown the effect of disconnecting bypass capacitor in CE amplifier using PSPICE software 30M (CO4)

4. A. Draw the circuit diagram of crystal oscillator 6M (CO3)
   B. Generate a frequency of 1KHz sinusoidal waveform with Hartley oscillator using PSPICE software. 18M (CO4)
   C. Observe the output waveform of Collpits oscillator by varying tank circuit component values. 30M (C03)

UNIT TEST –I

Model Question Paper (C-20)

EC-307 Electronic Circuits - I Lab

TIME: 3 hours Total Marks: 60

Instructions:

(1) Any one full question of the following shall be allotted to the students on lottery basis.

(2)All the questions are competency based and are for assessing the candidate's psychomotor skills

(3) Underpinning knowledge shall be assessed through viva voce 6 M

1. A. Draw the circuit diagram of Half wave rectifier. 6M (CO1)

   B. Connect the IC regulator circuit to get a constant voltage of +5V. 18M (CO1)

   C. Observe and note down the frequency response characteristics of a RC coupled amplifier. 30M (CO2)

2. A. Identify the terminals of IC 7912. 6M (CO1)

   B. Connect a rectifier circuit to get a ripple factor of 1.21 18M (CO1)

   C. Observe and note down Frequency response characteristics of a transformer coupled CE amplifier. 30M (CO2)

3. A. Draw the circuit diagram of RC coupled amplifier. 6M (CO2)

   B. Connect the circuit diagram of Bridge rectifier. 18M (CO1)

   C. Obtain the voltage regulation characteristics of Zener regulator with varying loads. 30M (CO1)

4. A. Draw the circuit diagram of Zener regulator for load regulation. 6M (CO1)

   B. Connect RC coupled amplifier circuit to get uniform frequency response in audio frequency range. 18M (CO2)

   C. Observe and note down ripple voltage of a bridge rectifier at different loads. 30M (C01)

5. A. Draw the circuit diagram of Hartley oscillator 6M (CO3)

   B. Connect the circuit diagram of HWR using PSPICE software. 18M (CO4)

   C. Observe and note down the effect of varying the RC component value on frequency response of RC phase shift oscillator using PSPICE software 30M (CO4)

6. A. Draw the circuit diagram of Zener regulator for load regulation. 6M (CO4)

B. Connect the RC phase shift oscillator to generate sustained oscillations using PSPICE software. 18M (CO4)

C. Obtain the output waveform of Hartley oscillator using PSPICE software. 30M (CO4)

7. A. Identify the required components to implement RC phase shift oscillator. 6M (CO3)

B. Connect the circuit diagram of Zener regulator for line regulation using PSPICE software. 18M (CO4)

C. Observe and notedown the effect of disconnecting bypass capacitor in CE amplifier using PSPICE software 30M (CO4)

8. A. Draw the circuit diagram of crystal oscillator 6M (CO3)

B. Generate a frequency of 1KHz sinusoidal waveform with Hartley oscillator using PSPICE software. 18M (CO4)

C. Observe the output waveform of Collpits oscillator by varying tank circuit component values. 30M (C03)