VOLTBOOK / GTU DIPLOMA ELECTRICAL

Electronic Devices and Circuits

DETAILED OUTCOME-BASED PRACTICAL MANUAL

COURSE CODE	SEMESTER	PRACTICALS	EFFECTIVE FROM
DI01C09011	1	15	2024-25

Prepared from the Suggested Course Practical List in the current GTU DI-series syllabus, effective 2024-25.

The organization follows the familiar outcome-based pattern used in legacy DTE laboratory manuals. All instructional text is independently written for this edition. This is not an official GTU, DTE or CTE publication.

Student name: _____

Enrollment no.: _____ Batch: _____

Institute: _____

UNIVERSITY-DRAFTED FIGURE EDITION 6.0 / 20 JULY 2026

Certificate

This is to certify that _____, enrollment number _____, has satisfactorily completed the prescribed practical work for Electronic Devices and Circuits (DI01C09011) during the academic term _____ under the supervision of the department.

Laboratory faculty	Head of department	Principal
Signature and date	Signature and date	Signature and date

Preface

This manual turns the current syllabus practical list into a usable student record. Each practical includes an original experiment-specific vector diagram and is arranged from objective and outcomes through prerequisite theory, setup, resources, safety, procedure, observations, interpretation, questions, references and a 25-mark assessment rubric.

Students should complete pre-lab preparation before the session and record actual readings during the session. Faculty may adapt component values, instrument ranges, software versions and local assessment requirements without changing the intended practical outcome.

Diagram drafting benchmarks were reviewed from Aurora's Electrical Circuits and Simulation manual, MITS Electronic Devices and Circuits manual, Sree Vahini's Electrical Measurements manual, and MSBTE Electrical Estimating and Contracting practice. Edition 6.0 applies stricter university drafting: complete current paths, IEC-style junctions and terminals, protection, instrument coils, test points, load terminals and measurement notes. Every figure is newly drawn and aligned to the current GTU practical title.

Official syllabus reference

Open the referenced GTU syllabus PDF

Programme outcomes and course outcomes

Programme outcomes

Code	Outcome
PO1	Basic and discipline-specific knowledge: apply mathematics, science and engineering fundamentals.
PO2	Problem analysis: identify and analyze well-defined engineering problems using standard methods.
PO3	Design/development of solutions: develop solutions for well-defined technical problems.
PO4	Engineering tools, experimentation and testing: use modern tools and interpret test results.
PO5	Engineering practices for society, sustainability and environment: apply safe and responsible practice.
PO6	Project management: apply engineering management principles individually and in teams.
PO7	Lifelong learning: recognize the need for independent learning in changing technology.

Course competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

Course outcomes

CO	Course outcome
CO1	Implement different rectifier and filter circuits.
CO2	Illustrate transistor operation, transistor amplifiers and biasing.
CO3	Explain the operation and applications of semiconductor and optoelectronic devices.

Practical outcome to course outcome matrix

The mapping below is for learning guidance. Faculty should use the assessment scheme prescribed by the institute.

No.	Suggested practical	Mapped CO
1	Test characteristics of a PN junction diode	CO1
2	Test characteristics of a half-wave rectifier using CRO	CO1
3	Test characteristics of a full-wave center-tapped rectifier using CRO	CO1
4	Test characteristics of a full-wave bridge rectifier using CRO	CO1
5	Compare output waveforms of different filters using CRO	CO1
6	Test a Zener diode as a voltage regulator	CO1
7	Test performance characteristics of a CE transistor amplifier	CO2
8	Test a transistor using a multimeter	CO2
9	Demonstrate CRO waveforms for a transistor used as a switch	CO2
10	Demonstrate the working of a MOSFET amplifier	CO2
11	Demonstrate the working of an SCR	CO3
12	Demonstrate the working of a UJT	CO3
13	Display alphanumeric characters on a seven-segment LED display	CO3
14	Test characteristics of an LDR	CO3
15	Demonstrate the working of optical fiber	CO3

Industry skills and laboratory guidance

Industry-relevant skills

- Breadboard construction with correct polarity
- CRO/DSO waveform measurement
- Semiconductor testing and fault isolation
- Comparison of measured and expected characteristics

Guidelines for instructors

1. Confirm the practical outcome, risk controls, apparatus readiness and emergency arrangements before the session.
2. Demonstrate only the critical connection, software or measurement steps; require students to reason through the remaining work.
3. Check circuit polarity, earthing, isolation, ranges and ratings before energization.
4. Assess both process and result. Give credit for safe practice, honest data, teamwork and technically sound interpretation.
5. Adapt values and equipment to local facilities while preserving the mapped course outcome.

Instructions for students

1. Read the practical, write the prediction and prepare the setup before entering the laboratory.
2. Record instrument identification, range, least count and component ratings before use.
3. Enter raw readings directly with units. Strike through errors once; do not erase or fabricate data.
4. Switch OFF and verify isolation before changing a connection. Report damage, heating, smell or unstable readings immediately.
5. Attach graphs, code listings, drawings, estimates and technical evidence behind the relevant practical.

Progressive assessment rubric

Each practical is assessed out of 25 marks. The practical-specific rubric repeats at the end of every experiment.

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Suggested interpretation

Total	Level	Interpretation
21-25	Excellent	Independent, accurate, safe and well interpreted
16-20	Good	Sound performance with minor correction
11-15	Satisfactory	Outcome achieved with guidance
0-10	Needs improvement	Repeat preparation or practical work as directed

Safety acknowledgement

I understand that institute rules and faculty instructions take priority over this manual. I will not energize, modify or touch a circuit without authorization.

Student signature and date	Faculty signature and date

Continuous assessment record

Practical	Date	Marks /25	Faculty initials
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
TOTAL		/375	

Experiment index

PRACTICAL 01

Test characteristics of a PN junction diode

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test characteristics of a PN junction diode.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO1: Implement different rectifier and filter circuits.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

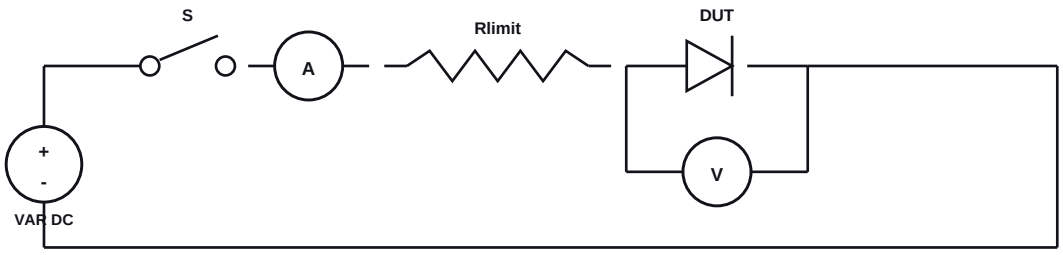
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.1 - PN DIODE V-I CHARACTERISTIC VERIFY VALUES BEFORE USE



Instructor-approved isolated/current-limited supply

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test characteristics of a PN junction diode'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 02

Test characteristics of a half-wave rectifier using CRO

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test characteristics of a half-wave rectifier using CRO.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO1: Implement different rectifier and filter circuits.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

Key relations / checks

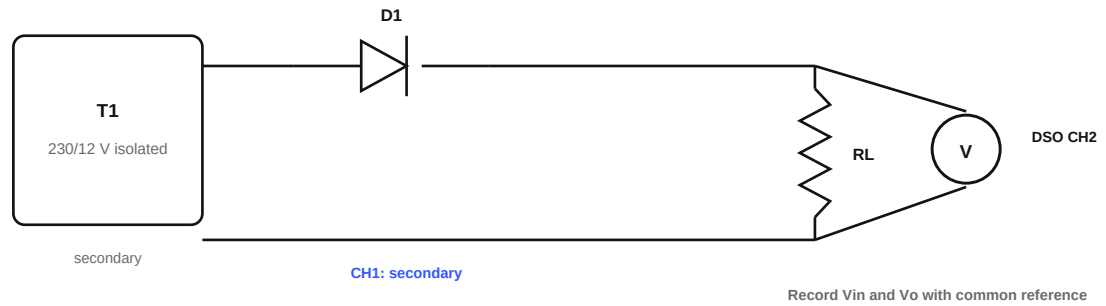
- Ripple factor r = Vac(rms) / Vdc
- Efficiency = Pdc / Pac x 100
- PIV and diode current ratings must not be exceeded

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.2 - HALF-WAVE RECTIFIER WITH MEASUREMENT POINTS

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test characteristics of a half-wave rectifier using CRO'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 03

Test characteristics of a full-wave center-tapped rectifier using CRO

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test characteristics of a full-wave center-tapped rectifier using CRO.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO1: Implement different rectifier and filter circuits.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

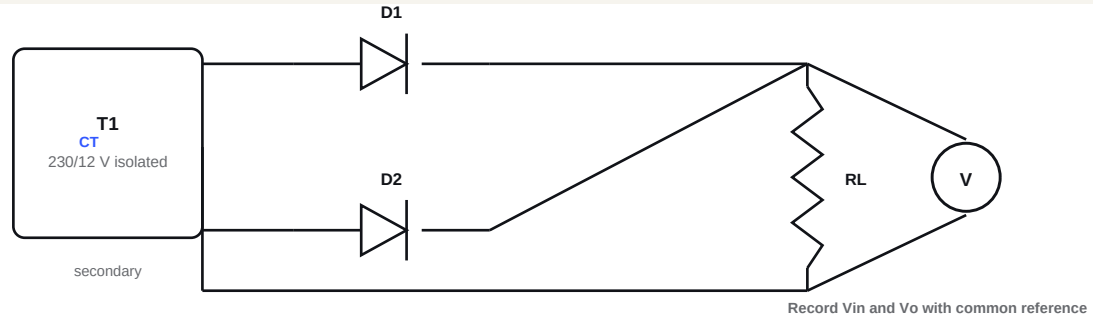
Key relations / checks

- Ripple factor r = Vac(rms) / Vdc
- Efficiency = Pdc / Pac x 100
- PIV and diode current ratings must not be exceeded

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.3 - CENTER-TAPPED FULL-WAVE RECTIFIER VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test characteristics of a full-wave center-tapped rectifier using CRO'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 04

Test characteristics of a full-wave bridge rectifier using CRO

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test characteristics of a full-wave bridge rectifier using CRO.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO1: Implement different rectifier and filter circuits.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

Key relations / checks

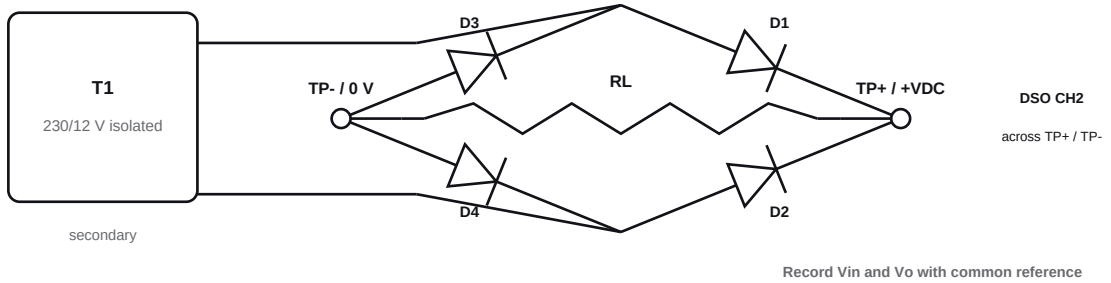
- Ripple factor r = Vac(rms) / Vdc
- Efficiency = Pdc / Pac x 100
- PIV and diode current ratings must not be exceeded

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.4 - FULL-WAVE BRIDGE RECTIFIER WITH LOAD AND DSO

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test characteristics of a full-wave bridge rectifier using CRO'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 05

Compare output waveforms of different filters using CRO

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Compare output waveforms of different filters using CRO.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO1: Implement different rectifier and filter circuits.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

Key relations / checks

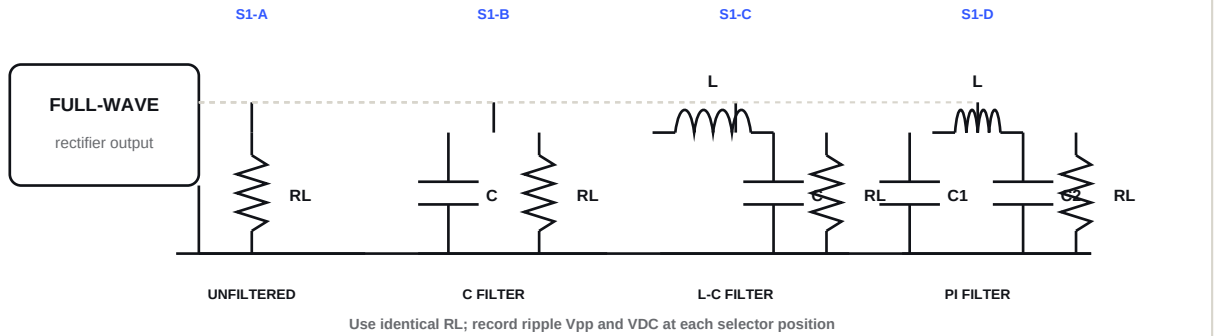
- Ripple factor r = Vac(rms) / Vdc
- Efficiency = Pdc / Pac x 100
- PIV and diode current ratings must not be exceeded

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.5 - RECTIFIER-FILTER COMPARISON USING THE SAME LOAD

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Keep the supply OFF. Build the approved full-wave rectifier and connect the specified resistive load; leave the filter section disconnected.
2. Apply the rated isolated input and use the DSO to record the unfiltered output waveform, average DC value and ripple peak-to-peak value.
3. Switch OFF and discharge every capacitor through a resistor. Connect the capacitor filter, re-energize, and record the same quantities without changing the input or load.
4. Repeat the measurement for the LC filter and then the pi (C-L-C) filter, observing the shown polarity and component ratings each time.
5. For every arrangement, calculate ripple factor from the measured AC-ripple and DC components and tabulate voltage regulation if required.
6. Plot or place the four output waveforms on common scales and compare smoothing, DC level, regulation and component stress.
7. Switch OFF, verify zero voltage, safely discharge capacitors, disconnect the circuit and state which filter is most suitable for the specified load.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Compare output waveforms of different filters using CRO'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 06

Test a Zener diode as a voltage regulator

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test a Zener diode as a voltage regulator.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO1: Implement different rectifier and filter circuits.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

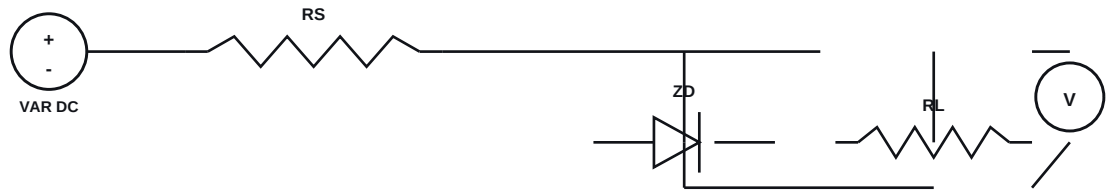
Key relations / checks

- Series resistance limits source current
- IL = VL/RL
- IZ = IS - IL within the rated Zener range

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.6 - ZENER SHUNT VOLTAGE REGULATOR VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test a Zener diode as a voltage regulator'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 07

Test performance characteristics of a CE transistor amplifier

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test performance characteristics of a CE transistor amplifier.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO2: Illustrate transistor operation, transistor amplifiers and biasing.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

Key relations / checks

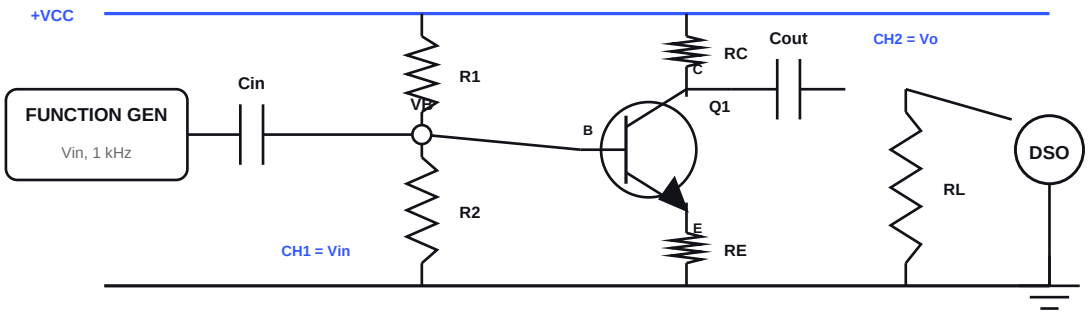
- BJT current gain beta = IC/IB
- Voltage gain Av = Vo/Vi
- Keep the device within its safe operating area

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.7 - VOLTAGE-DIVIDER BIASED COMMON-EMITTER AMPLIFIER

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test performance characteristics of a CE transistor amplifier'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 08

Test a transistor using a multimeter

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test a transistor using a multimeter.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO2: Illustrate transistor operation, transistor amplifiers and biasing.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

Key relations / checks

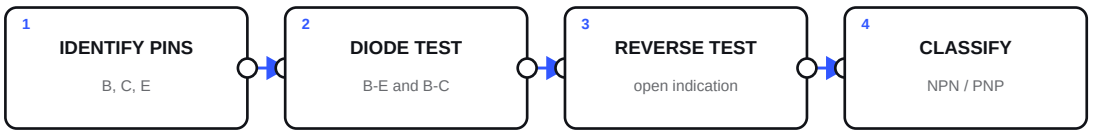
- BJT current gain beta = IC/IB
- Voltage gain Av = Vo/Vi
- Keep the device within its safe operating area

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.8 - TRANSISTOR JUNCTION TEST WITH DMM

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test a transistor using a multimeter'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 09

Demonstrate CRO waveforms for a transistor used as a switch

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Demonstrate CRO waveforms for a transistor used as a switch.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO2: Illustrate transistor operation, transistor amplifiers and biasing.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

Key relations / checks

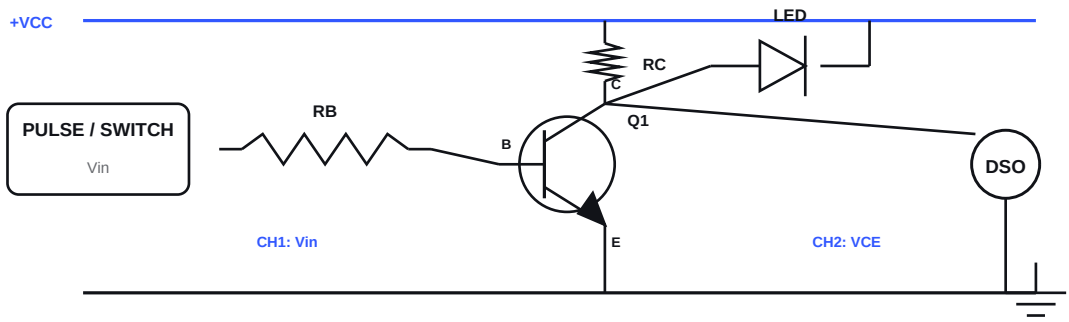
- BJT current gain beta = IC/IB
- Voltage gain Av = Vo/Vi
- Keep the device within its safe operating area

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.9 - NPN TRANSISTOR USED AS A SATURATED SWITCH

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Demonstrate CRO waveforms for a transistor used as a switch'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 10

Demonstrate the working of a MOSFET amplifier

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Demonstrate the working of a MOSFET amplifier.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO2: Illustrate transistor operation, transistor amplifiers and biasing.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

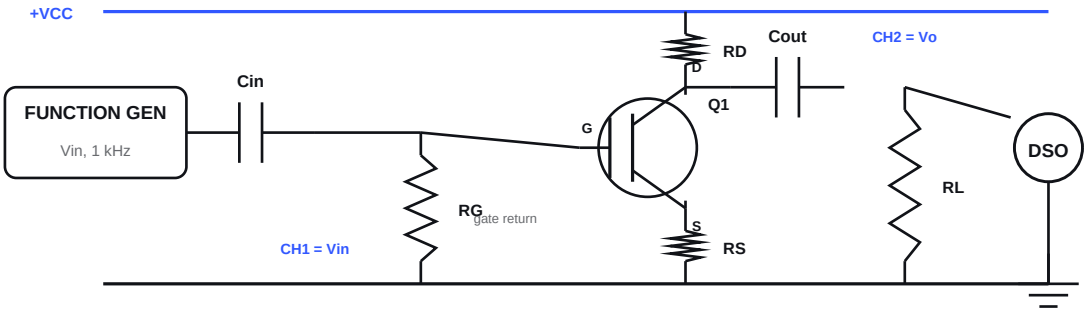
Key relations / checks

- BJT current gain beta = IC/IB
- Voltage gain Av = Vo/Vi
- Keep the device within its safe operating area

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.10 - COMMON-SOURCE MOSFET AMPLIFIER VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Demonstrate the working of a MOSFET amplifier'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 11

Demonstrate the working of an SCR

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Demonstrate the working of an SCR.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO3: Explain the operation and applications of semiconductor and optoelectronic devices.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

Key relations / checks

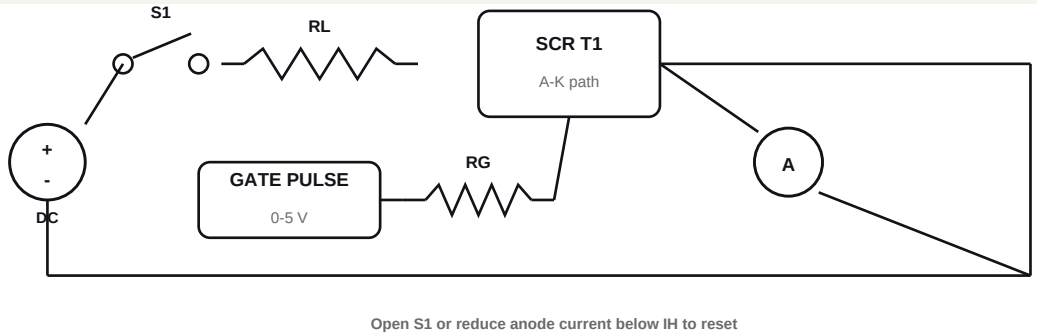
- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.11 - SCR GATE TRIGGERING, LATCHING AND HOLDING-CURRENT TEST

VERIFY VALUES BEFORE USE



Open S1 or reduce anode current below IH to reset

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Demonstrate the working of an SCR'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 12

Demonstrate the working of a UJT

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Demonstrate the working of a UJT.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO3: Explain the operation and applications of semiconductor and optoelectronic devices.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

Key relations / checks

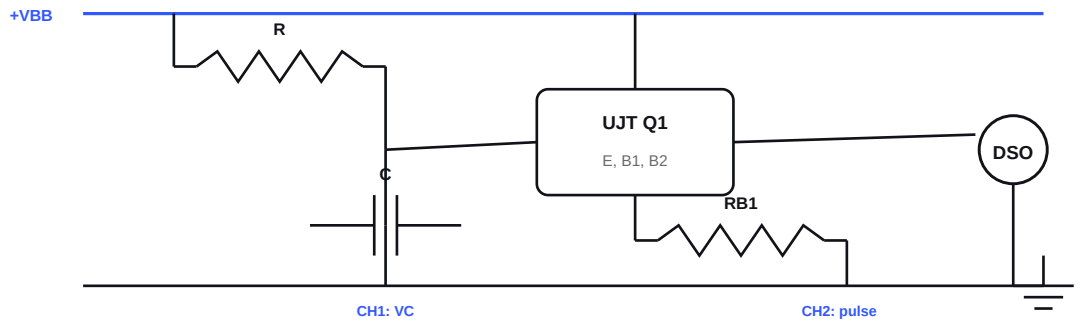
- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.12 - UJT RELAXATION OSCILLATOR AND DSO MEASUREMENT

VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Demonstrate the working of a UJT'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 13

Display alphanumeric characters on a seven-segment LED display

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Display alphanumeric characters on a seven-segment LED display.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO3: Explain the operation and applications of semiconductor and optoelectronic devices.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

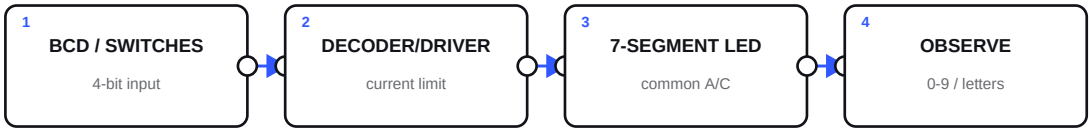
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.13 - SEVEN-SEGMENT DISPLAY CONNECTION VERIFY VALUES BEFORE USE



Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Display alphanumeric characters on a seven-segment LED display'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 14

Test characteristics of an LDR

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Test characteristics of an LDR.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO3: Explain the operation and applications of semiconductor and optoelectronic devices.

E. Practical learning outcomes

1. Prepare the circuit, select suitable ranges and predict the expected response.
2. Perform controlled measurements safely and record readings with correct units.
3. Compare measured and calculated results and explain the observed difference.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

Semiconductor behavior is verified by measuring terminal voltage/current or input/output waveforms. Use a current-limited low-voltage source, observe polarity and device ratings, vary only one parameter at a time, and compare the measured characteristic with the expected device model.

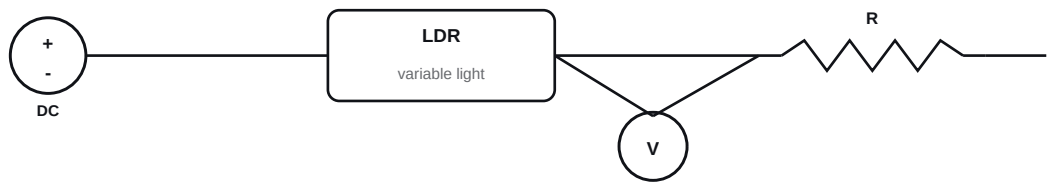
Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.14 - LDR VOLTAGE-DIVIDER CHARACTERISTIC VERIFY VALUES BEFORE USE



Change illuminance; record resistance and divider voltage

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record instrument ranges and least counts. Enter observed readings first, then calculated values. Do not replace actual readings with expected values.

Trial	Applied value	Measured value 1	Measured value 2	Calculated result

SAMPLE CALCULATION WITH UNITS AND PERCENTAGE ERROR

GRAPH / PHASOR / CHARACTERISTIC / ADDITIONAL READINGS

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Test characteristics of an LDR'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

PRACTICAL 15

Demonstrate the working of optical fiber

DATE	BATCH	ROLL / ENROLLMENT NO.	FACULTY SIGN

A. Objective

Demonstrate the working of optical fiber.

B. Expected programme outcomes

PO1, PO2, PO4, PO7.

C. Expected competency

Test and troubleshoot semiconductor devices and basic electronic circuits using appropriate instruments.

D. Expected course outcome

CO3: Explain the operation and applications of semiconductor and optoelectronic devices.

E. Practical learning outcomes

1. Identify construction, rating, operating principle and application of the item or system.
2. Record observations in a labelled diagram and comparative technical table.
3. Form a justified conclusion using verified technical evidence.

F. Affective-domain outcomes

1. Follow electrical safety, laboratory discipline and good housekeeping.
2. Record observations honestly with units, dates and traceable corrections.
3. Share instruments responsibly and complete the work within the allotted time.

G. Prerequisite theory

This is an identification and engineering-observation exercise. Record construction, ratings, operating principle, application, limitations and safety requirements for every item or system studied. Use nameplate data and current manufacturer or utility information; clearly distinguish observation from inference.

Key relations / checks

- State the governing relation before substitution
- Use consistent SI units
- % difference = |observed - expected|/expected x 100

H. Experimental setup / drawing

Study the experimental circuit below. Enter the component values, instrument ranges, terminal polarity and protection used in your laboratory, then obtain instructor approval before connection.

FIG. H.15 - OPTICAL-FIBER COMMUNICATION DEMONSTRATION

VERIFY VALUES BEFORE USE

Engineering-diagram note: Confirm the actual component values, ratings, terminal numbers, instrument ranges and protective measures issued by your laboratory. Faculty approval is mandatory before energizing.

I. Resources and equipment required

Resource	Specification / range	Quantity
Regulated DC supply	0-30 V, current limited	1
DMM and CRO/DSO	Suitable range/bandwidth	1 each
Function generator	Where waveform input is required	1
Breadboard / trainer	Inspected	1
Devices and components	As per circuit and ratings	1 set

J. Safety and precautions

1. Do not energize or alter a circuit without instructor approval.
2. Use intact leads, correct instrument ranges, rated components and required PPE.
3. Switch OFF, isolate and verify absence of voltage before touching conductors.
4. Observe IC/device orientation, common ground and current limits; avoid static discharge.

K. Procedure

1. Study the circuit or connection diagram, predict the expected result, and select instruments with suitable ranges.
2. Keep the supply OFF. Inspect leads and components, set controls to minimum, and make the circuit exactly as shown.
3. Ask the instructor to verify connections, polarity, earthing, instrument range and component ratings before energizing.
4. Switch ON using an isolated/current-limited source. Increase the input gradually and watch for abnormal heating or readings.
5. Take at least five sets of stable readings over the safe operating range and record units immediately.
6. Switch OFF before changing any connection. Repeat only the approved changes required by the experiment.
7. Calculate theoretical values and percentage error, plot the required characteristic where applicable, and state the result.

L. Observations and calculations

Record verified ratings and constructional observations. Identify the source of any information not obtained directly from the sample or site.

Item / parameter	Rating / value	Construction / principle	Application	Remarks

LABELLED SKETCH / SINGLE-LINE DIAGRAM / COMPARATIVE NOTES

M. Interpretation of results

COMPARE OBSERVED AND EXPECTED BEHAVIOUR; EXPLAIN ERROR, LIMITATIONS OR DESIGN TRADE-OFFS

N. Conclusion

STATE WHETHER THE PRACTICAL OUTCOME WAS ACHIEVED AND SUPPORT IT WITH KEY EVIDENCE

O. Practical-related questions

No.	Question / answer
1	What physical principle or engineering rule is verified in 'Demonstrate the working of optical fiber'? Answer: _____
2	Why was the selected instrument range, component rating or data source suitable? Answer: _____
3	Which two errors or uncertainties have the greatest effect on this result? Answer: _____
4	What safety step must be completed before changing a connection or configuration? Answer: _____

P. References and suggestions

1. V. K. Mehta and Rohit Mehta, Principles of Electronics
2. Thomas L. Floyd, Electronic Devices
3. Current GTU syllabus DI01C09011 and institute laboratory instructions

Q. Assessment rubric (25 marks)

Assessment criterion	5 - Excellent	4 - Good	3 - Satisfactory	2/1/0 - Needs improvement	Marks
Correct circuit/interface/drawing interpretation	Complete, correct and independently prepared	Minor correction needed	Adequate with guidance	Major error, unsafe or incomplete	/5
Practical skill, measurement and safety	Systematic, accurate and safe	Sound method; small lapse	Acceptable with guidance	Weak method or unsafe practice	/5
Professional conduct and team contribution	Ethical, orderly and constructive	Responsible with minor lapse	Generally acceptable	Poor discipline or contribution	/5
Result interpretation and conclusion	Evidence-based and insightful	Correct with minor omission	Basic valid conclusion	Unsupported or incorrect	/5
Timely completion and record quality	Complete, neat and on time	Nearly complete and timely	Usable record	Late, unclear or incomplete	/5
TOTAL					/25

Faculty remarks	Student response / correction completed

Final submission checklist

1. Every practical has a date, mapped outcome, actual readings or evidence, calculations and a signed conclusion.
2. Circuit diagrams, programs, graphs, estimates, reports and test sheets are attached where required.
3. Instrument ranges, component ratings, source dates and safety precautions are recorded.
4. Technical sources are acknowledged and all assumptions are stated.
5. Faculty feedback and required corrections have been completed.

FACULTY REMARKS