SONOPANT DANDEKAR ARTS, V.S. APTE COMMERCE AND M.H. MEHTA SCIENCE COLLEGE, PALGHAR

Standard Operating Procedure

Department of Physics

DEPARTMENT OF
PHYSICS

$E = mc^2$

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Information

Sr. No	Laboratory Name/Number	Floor	Area in sq feet
1	Physics Lab – 1 Room No - 28	2nd	800
2	Physics Lab – 2 Room No - 27	2nd	800
3	Staff Room/ T.Y.B.Sc.	2nd	400
4	Dark Room – Room NO - 22	2nd	400
5	M.Sc. Lab – Room No - 25	2nd	400

List of Laboratory Instruments

3.1 List of Laboratory Instruments B.Sc.

Sr. No	List Laboratory Instruments	Quantity
1	AC Mili voltmeter	02
2	Adjustable Silt	05
3	As table kit	05
4	Battery Eliminator	04
5	Balance	01
6	Ballistic Galvanometer	06
7	Bread Board	10
9	BI Prism	02
10	Beaker	07
11	Bar Magnet	05
12	Choke Sodium lamp	01
13	Canon Printer	01

14	C.R. O	11
15	Condenser Box	04
16	Diode Laser with Stand	01
17	Drill Machine	01
18	Digital Stop Watch	18
19	Digital multi meter	23
20	Elastic Constant of Rubber Tube	01
21	E/M App	01
22	Flywheel	02
23	Fix Induction Box	05
24	Gonio meter	01
25	Grating	05
26	Hysteresis App	01
27	Hall effect kit	01
28	Hot plate	04
29	Keter's Pendulum	02
30	Lee's Method	02
31	Laser Beam App	01
32	Log Decrement App	01
33	Lamp Sodium	02
34	Millimeter /Mill voltmeter	14
36	Millivolt meter DC-200/AC-200	13
37	Micro Meter (MA)	15
38	Mercary Lamp	01

39	Mono stable Kit	01
40	Microprocessor Kit	02
41	Millimeter	41
42	Mag-A	02
43	Optical Bench	02
44	Power Supply	35
45	PH Meter	01
46	Prism	11
47	Polarizer (Analiaser)	06
48	Rheostat	30
49	Resistance Box	18
50	Retort Stand	30
51	Squrewave Generator	14
52	Spectrometer	05
53	Sonometer Box	17
54	Telescope	09
55	Travelling Microscope	10
56	Torsional App	01
57	Tuning Fork	18
58	Thermometer	09
59	Vernier caliper	35
60	Voltmeter	37
61	Weight Box	12

3.2 List of Laboratory Instruments M-Sc

Sr. No.	List Laboratory Instruments	Quantity
1	ARM7 Interfacing Board-LPC21XX	01
2	Dielectric Constant Solid	01
3	Double Slit	01
4	Interfacing Board-89C51RD2	01
5	Interfacing 8-bit DAC Kit	01
6	LVDT KIT	01
7	Michelson's Interferometer	01
9	Microprocessor Kit 8085	02
10	Microcontroller Kit 8051	02
11	Motherboard VLSI Kit TK base ADM	01
12	Resistivity by Four Probe	01
13	PIC Microcontroller PIC 16F877 or 18F4520	01
14	Stepper Motor with Interface Card	01
15	Vacuum tube Photocell Planck's Constant	01
16	VHDL Kit ADM 6 ADM XILINX 6	01
17	Ultrasonic Interferometer	01

General safety guidelines of Physics Laboratory

1. **Personal Protective Equipment (PPE):**

- Wear appropriate PPE such as safety goggles, lab coats, gloves, and closed-toe shoes at all times.
- Tie back long hair and avoid loose clothing or accessories that could get caught in equipment.

2. **Physical Hazards:**

- Keep work areas clean and organized to prevent trips, slips, and falls.
- Use caution when lifting heavy objects, and ask for assistance if needed.
- Be mindful of moving parts and equipment to avoid accidents.

3. **Fire Safety:**

- Have a clear understanding of fire prevention measures and fire extinguisher locations.
- Understand evacuation procedures and emergency contact information.
- Keep flammable materials away from heat sources, and use fire-resistant containers when necessary.

4. **First Aid:**

- Have a well-stocked first aid kit readily available in the laboratory.
- Ensure personnel are trained in basic first aid procedures.

5. **Equipment Safety:**

- Inspect equipment before use to ensure it is in proper working condition.
- Read and follow operating procedures provided by the manufacturer.
- Never modify equipment without authorization and proper training.
- Never leave experiments unattended while in progress.
- Handle laboratory equipment and glassware with care to prevent breakage or injury.
- Dispose of broken glass properly in designated containers.

6. **Electrical Safety:**

- Inspect electrical cords, plugs and equipment for damage before use.
- Avoid overloading electrical outlets and use ground fault circuit interrupters (GFCIs) where necessary.

- Do not use equipment with frayed cords or wires.
- Do not use electrical equipment near water or other liquids.
- Don't work with electrical equipment when your hands are wet, and use insulated tools when necessary.

7. Laser Safety:

- Follow laser safety guidelines when working with lasers, including wearing appropriate eyewear and avoiding direct eye exposure.

8. Handling Chemicals:

- Read and understand the Safety Data Sheets (SDS) for all chemicals used in experiments.
- . Follow proper procedures for handling, storing, and disposing of hazardous chemicals.
- Label all containers correctly and be aware of chemical hazards and compatibility
- Never mix chemicals unless instructed to do so by a qualified supervisor.

9. Training and Supervision:

- All personnel should undergo thorough safety training before beginning work in the laboratory.
- Supervisors should provide oversight and guidance to ensure safety protocols are followed.

10. Reporting Unsafe Conditions:

- Report any damage, accidents or unsafe conditions immediately.
- Take proactive measures to address potential hazards and maintain a safe working environment.
- Learn from incidents to prevent future occurrences and improve safety practices

General instructions for teachers of physics laboratory

1. **Safety First:** Emphasize the importance of safety protocols and ensure students understand and follow them at all times. This includes wearing appropriate protective gear, handling equipment properly, and being aware of emergency procedures including evacuation routes, location of safety equipment (fire extinguishers, eyewash stations, etc.), and whom to contact in case of an emergency.

2. **Equipment Familiarization:** Provide thorough explanations and demonstrations of the laboratory equipment before students begin experiments. Ensure students know how to use each piece of equipment safely and effectively.

3. **Experiment Procedures:** Clearly outline the procedures for each experiment, including any necessary calculations or data collection methods. Encourage students to ask questions and seek clarification if they are unsure about any aspect of the experiment.

4. **Group Work:** Assign students to groups for collaborative work during experiments. Encourage teamwork, communication, and problem-solving skills among group members.

5. **Data Recording:** Emphasize the importance of accurate data recording and encourage students to take detailed notes throughout the experiment. Remind them to record all observations, measurements, and any unexpected results.

6. **Data Analysis**: Guide students through the process of analyzing their data and drawing conclusions based on their observations. Encourage critical thinking and discussion about the significance of their findings.

7. **Troubleshooting:** Be prepared to assist students with troubleshooting any issues or challenges they encounter during the experiment. Encourage them to think critically and problem-solve independently whenever possible.

8. **Post-Experiment Discussion:** Lead a discussion after each experiment to review the results, discuss any discrepancies or unexpected outcomes, and reinforce key concepts covered in the lab.

9. **Clean-Up:** Ensure that students clean up their workspaces and properly store all equipment and materials at the end of each lab session. Reinforce the importance of maintaining a clean and organized laboratory environment.

10. **Feedback and Assessment:** Provide constructive feedback to students on their performance during the lab sessions. Assess their understanding of the concepts covered and their ability to apply them in a hands-on setting. Encourage continuous improvement and offer support as needed.

11. **Continuously educate and Train:** Staff members should participate in regular safety training sessions and stay updated on the latest safety protocols and procedures relevant to the laboratory.

By following these some instructions, staff can contribute to a safe and productive working environment in the physics laboratory while minimizing risks and ensuring accurate results.

Some instructions for students in physics laboratories

For students working in physics laboratories, it's essential to follow instructions carefully to ensure safety, learn effectively, and achieve accurate results.

1. **Safety first:** Always wear appropriate personal protective equipment (PPE) such as safety goggles and lab coats. Familiarize yourself with the location of emergency equipment like fire extinguishers and eye wash stations.
2. **Read instructions carefully:** Before starting any experiment, thoroughly read the experiment instructions, including safety precautions and procedures.
3. **Ask questions:** If you're unsure about any aspect of the experiment, don't hesitate to ask your instructor for clarification. It's better to ask beforehand than to make a mistake during the experiment.
4. **Handle equipment with care:** Treat all laboratory equipment with care and respect. Follow proper handling procedures to avoid damaging equipment or causing accidents.
5. **Keep your workspace organized:** Maintain a clean and organized workspace to prevent accidents and ensure accurate results. Dispose of waste properly and return equipment to its proper place after use.
6. **Take accurate measurements:** Pay close attention to measurement units and precision when recording data. Use appropriate measuring tools and techniques to ensure accuracy.
7. **Record data diligently:** Record all data and observations neatly and accurately in your lab notebook. Include relevant details such as equipment used, procedure followed, and any unexpected observations.
8. **Analyze results critically:** After completing the experiment, analyze your data and results critically. Look for trends, patterns, and sources of error. Compare your results with expected outcomes and discuss any discrepancies.

9. **Clean up after yourself:** Clean all equipment and work surfaces thoroughly after completing the experiment. Dispose of any waste materials properly and return all borrowed equipment to its designated storage area.

10. **Review and learn from the experience:** Take time to review your notes and reflect on the experiment. Consider what you've learned and how it applies to the principles of physics. Note any areas for improvement or further exploration.

Physics Department Laboratories

Physics Lab 1: Room No-27

Physics Lab 2: Room No-28

Physics Lab 3: Room No-22 (Dark Room)

Physics Lab 4: Room No-25 (M.Sc.)

Department and Laboratory Cleanliness:

Task	Frequency
Clean all working surfaces	Daily
Clean of dusting of machine / equipment	Daily
Disinfect and clean all sinks and wash basins	Daily
Clean of tile floors	Daily
Disinfect door handles (inside and outside)	Daily
Clean furniture	Daily
Clean chalk boards and chalk trays	Daily
Check for burned out lights	Daily
Wipe all horizontal surfaces, including students desks	Daily
Clean Dust Bin	Daily
Clean doors, horizontal surfaces, windows and walls	Weekly
Wash Dust Bin	Weekly
Dust ceiling area and light fixtures	Monthly

General Physics Laboratory safety practices:

There are many types of experiments carried out in the Physics Laboratory. We will first list the general SOP applicable at all times.

1. Students must avoid bringing bags into the working area of the laboratory. This is to prevent accidental damage to the instruments or the bags and to avoid cluttering of the working table that might disturb the experiment.
2. No instruments or any material is to be taken from the laboratory without the express permission of the teachers or laboratory assistant.
3. Every object taken from the laboratory must be entered in the register.
4. At the end of the experiment, the student must submit the equipment to the laboratory assistant, even if the experiment is incomplete.
5. Any damage to any equipment must promptly be informed to the teachers or the laboratory assistant.
6. Prior permission from the teachers must be obtained for performing experiments at unallocated times.
7. Any injury to any student caused by an equipment must be brought to the notice of the teachers or laboratory assistant immediately.
8. During emergencies like fire, the students, teachers and the laboratory assistant will follow safety guidelines and exit in an orderly fashion; equipment and bags can be left behind as health and safety are bigger concerns.

Policies on the Use of Laboratory rooms

1. The key to all laboratory rooms is kept by the technicians. The technicians will open the lab rooms only when there are laboratory classes.
2. The laboratory Assistance must be the first and the last person in the laboratory room. Students are NOT allowed to enter the laboratory unless the Assistance is already present.
3. Only those officially enrolled in Physics Laboratory Courses are allowed to enter the laboratory.
4. Prohibited from smoking, eating, drinking, and littering in all physics laboratories.
5. Good housekeeping and safety precautions should be observed at all times.
6. Use all laboratory fixtures properly. Do not sit on tables and do not open cabinets or lockers unless there is an instruction to do so.
7. Maintain the cleanliness of the lab at all times.
8. The instructor should see to it that every utility (equipment, lights, water, gas, etc.) is turned off.

Policies on the Conduct of an Experiment

1. Students are advised to read all precautionary notes on all pieces of equipment before using them. All questions about safety precautions on the equipment being used must be addressed to the lab instructor.
2. The lab instructor must first check the setup for experiments requiring the use of electrical components before any of these are plugged in or turned on. In case of faulty equipment, the instructor must be informed immediately so that a replacement can be secured from the Physics Laboratory.
3. Experiments involving the use of boiling water, heaters, and the like must be performed close to the water sinks in the lab.
4. Chemicals used in some experiments must be handled with utmost care. Used and unused chemicals must be returned to the Physics Laboratory as soon as the experiment is finished. Chemicals should never be thrown into the water sinks or the trash bins.
5. The lab technicians may be requested by the lab instructor to assist during a lab experiment but they are not required to stay in the lab rooms.

Borrowing Procedures and Use of Equipment

1. The lab technicians in the Physics Lab are responsible for the safekeeping and lending of all equipment used in the Physics Teaching Lab.
2. All equipment necessary for physics experiments may be borrowed from the technicians at the Physics Lab.
3. Students must present an ID before any lab equipment is loaned.
4. Borrow only the required equipment which are specified in your experiment.
5. The borrower and his/her group are held responsible for all equipment borrowed from the Physics Lab.
6. All equipment borrowed must be returned upon completion of the experiment.

Stock Verification of Library Books:

Noting the Accession Number

1. Staff notes down the accession numbers of books on the library shelves.
2. Separate sheets of paper are prepared for each library shelf. Each member of the physical verification committee are given one set of sheets and is asked to note down the accession numbers of books in the library shelves that is specifically assigned to him.
3. While noting the accession numbers, book is physically checked and is taken out of shelf, if the book is damaged/beyond repair.

Re-verifying the missing Books

1. List of books again checked with collection.
2. The final list of missing books is reported to the Librarian for necessary action.

Equipment Maintenance:

I. Lab Equipment

Entry of Faulty Instruments

1. Enter the details of the faulty Instrument in the register assigned for it (laboratory specific).

Apply for Repair

1. In charge/Department committee takes the estimate for Instrument that needs to be repaired.
2. Submit repair budget to the principal.
3. As per requirement and availability of funds, In charge/Department committee will take permission for repair of Instruments from Principal.
4. After approval, Place order for repair (Invite quotations if required) as per rules applicable at the time.
5. Take the receipt of items given for repair from the vendor while giving him/her Instruments for repair.

Verification and Bill Processing

1. Instrument must be properly checked by faculty, while receiving the repaired Instruments.
2. Strike through the repaired Instrument from the register.
3. If faculty is satisfied with working of Instruments, Submit bills (In charge/Department committee) to accounts section for making payment to the vendor only after satisfying with the repaired Instrument.

Procurement of Goods/Items/Equipment

Steps for non-recurring items: -

Issuing the Item

1. After successful installation report, the procuring officer issues the item in the desired lab and thereafter it remains in the custody of the lab In-charge.

Labeling the Procured Item

1. Label procured items with reference number.

Maintaining Register

1. A register is maintained for the equipment.

Steps for Recurring items: -

Issuing the Item

1. After successful purchasing, the procuring officer issues the item in the desired lab and thereafter it remains in the supervision of the lab In-charge.

Maintaining the Record

1. Record is maintained for the usage.

Material Handling Procedures for Physics Laboratory Components

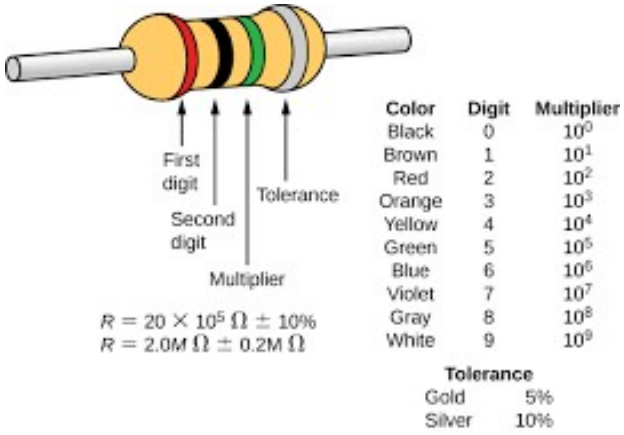
1. Introduction:

Material handling procedures in a physics laboratory extend beyond physical transportation and encompass the proper identification, storage, and usage of various components such as resistors, capacitors, and diodes. This report outlines specific handling procedures for these components, including the resistor color code method, capacitor identification, and diode polarity recognition.

2. Resistors:

a. Color Code Method:

- Familiarize personnel with the resistor color code system, which represents resistance values through color bands.
- Ensure proper lighting and magnification tools for accurate identification of color bands.
- Train staff to decode resistor values using color charts or calculators.
- Handle resistors with care to prevent damage to the color bands, which could hinder identification.



Color	Digit	Multiplier
Black	0	10^0
Brown	1	10^1
Red	2	10^2
Orange	3	10^3
Yellow	4	10^4
Green	5	10^5
Blue	6	10^6
Violet	7	10^7
Gray	8	10^8
White	9	10^9

Tolerance	
Gold	5%
Silver	10%

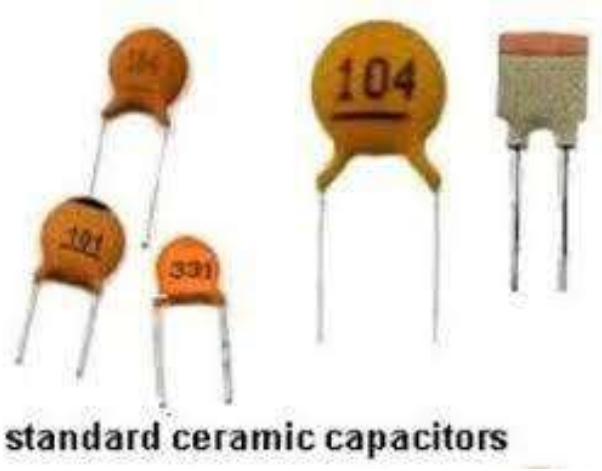
3. Capacitors:

a. Identification:

- Label capacitors clearly with their capacitance values, voltage ratings, and polarity (if applicable).
- Use capacitance meters or multimeters to verify capacitor values before use.
- Store capacitors in labeled containers or bins to prevent mix-ups and facilitate easy access.
- Pay attention to polarity in polarized capacitors, marking the positive and negative terminals accordingly.

To calculate value of Capacitors

$104 – 10 \times 10^4 \times 10^{-12} = 0.1\mu F$

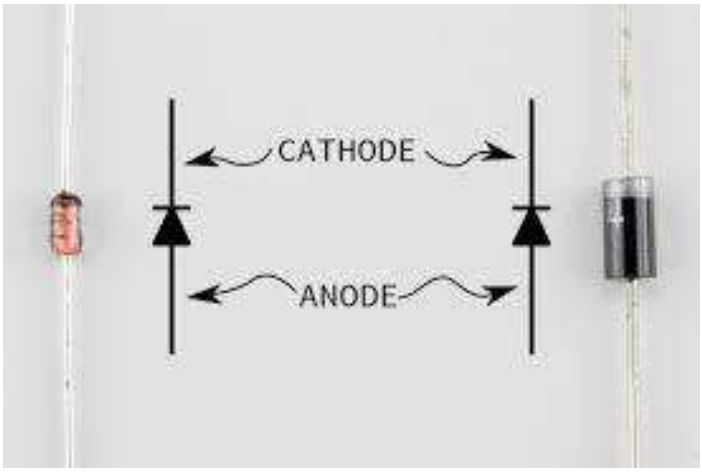


standard ceramic capacitors

4. Diodes:

a. Polarity Recognition:

- Identify the polarity of diodes using markings such as a band, arrow, or line indicating the cathode terminal.
- Utilize datasheets and manufacturer specifications to verify diode polarity and characteristics.
- Store diodes in containers or organizers with clear labeling to distinguish between different types and polarities.
- Avoid applying reverse voltage beyond the diode's specifications to prevent damage or failure.



5. General Handling Procedures:

a. ESD Protection:

- Implement electrostatic discharge (ESD) precautions when handling sensitive components to prevent damage from static electricity.
- Use ESD-safe workbenches, mats, wrist straps, and packaging materials.
- Ground workstations and equipment to dissipate static charges effectively.

6. Storage:

a. Organize components in designated storage areas with proper labeling and segregation.

b. Use anti-static packaging or containers for sensitive components to minimize the risk of ESD damage.

c. Maintain appropriate environmental conditions such as temperature and humidity to preserve component integrity.

7. Identification of Transistors:

Physical Appearance: Transistors are typically small, three-terminal semiconductor devices. They come in various packages such as TO-92, TO-220, SOT-23, etc.

Labeling: Transistors may have part numbers printed on them, indicating their type, characteristics, and manufacturer.

Terminal Identification: Transistors have three terminals: the base (B), the collector (C), and the emitter (E). Some transistors may also have additional terminals depending on their type (e.g., Darlington pairs).

Installation:

Follow datasheet or manufacturer guidelines for proper installation of transistors on circuit boards or other electronic devices.

Ensure correct orientation and alignment of transistor leads or terminals.

Use appropriate soldering techniques and temperatures to solder transistors onto circuit boards.

Usage:

Observe polarity and pinout configurations as specified in the datasheet.

Avoid exceeding maximum ratings such as voltage, current, and power dissipation.

Monitor temperature to prevent overheating, which can damage transistors.

Testing and Troubleshooting:

Use appropriate testing equipment such as multimeters, transistor testers, or curve tracers to verify transistor functionality.

Follow testing procedures outlined in datasheets or electronic test manuals.

Take precautions to avoid damaging transistors during testing.

8. Training and Documentation:

a. Provide comprehensive training to laboratory staff on the proper handling, identification, and storage of components.

b. Develop and maintain documentation, including component datasheets, color code charts, and handling procedures, for reference and training purposes.

c. Regularly review and update procedures based on feedback, technological advancements, and safety standards.

9. Conclusion:

Adhering to specific material handling procedures for resistors, capacitors, and diodes is essential for maintaining the integrity of laboratory experiments, ensuring safety, and prolonging the lifespan of components. By implementing the outlined guidelines and emphasizing training and documentation, physics laboratories can effectively manage and utilize these essential components.

10. Recommendations:

a. Conduct periodic audits to assess compliance with handling procedures and identify areas for improvement.

b. Encourage a culture of responsibility and accountability among laboratory staff regarding component handling and safety.

c. Stay updated on industry standards and best practices for material handling to enhance laboratory operations and safety protocols.

Material handling procedures for ammeters, voltmeters, and galvanometers:

Identification:

Ammeter:

Appearance: Typically has a digital or analog display with a scale indicating current in amperes (A).

Function: Measures the current flowing through a circuit.

Symbol: Usually represented by the letter 'A' in circuit diagrams.

Voltmeter:

Appearance: May have a digital or analog display, indicating voltage in volts (V).

Function: Measures the potential difference (voltage) between two points in a circuit.

Symbol: Often represented by the letter 'V' in circuit diagrams.

Galvanometer:

Appearance: Usually an analog instrument with a needle deflection mechanism.

Function: Detects and measures small electric currents.

Symbol: Represented by a 'G' in circuit diagrams.

Material Handling Procedures:

Safety Precautions:

Wear appropriate personal protective equipment (PPE) such as gloves and safety goggles.

Ensure the area is free from hazards and follow laboratory safety protocols.

Handling and Transportation:

Handle instruments with care to avoid damage to delicate components.

Use proper lifting techniques and avoid dropping or mishandling.

Securely package instruments during transportation to prevent damage.

Installation and Setup:

Place instruments on stable and level surfaces to prevent tipping.

Ensure proper ventilation and access to controls.

Follow manufacturer instructions for connections and setup.

Proper Connection:

Double-check connections to ensure they are secure and correctly aligned.

Use appropriate cables and connectors for reliable connections.

Usage and Operation:

Follow recommended operating procedures provided by the manufacturer.

Use appropriate measurement techniques for accurate readings.

Monitor readings for abnormalities and ensure instruments are functioning correctly.

Shutdown and Storage:

Safely shut down instruments according to manufacturer instructions.

Disconnect power and signal connections before storage.

Store instruments in a clean, dry area protected from dust and moisture.

Emergency Procedures:

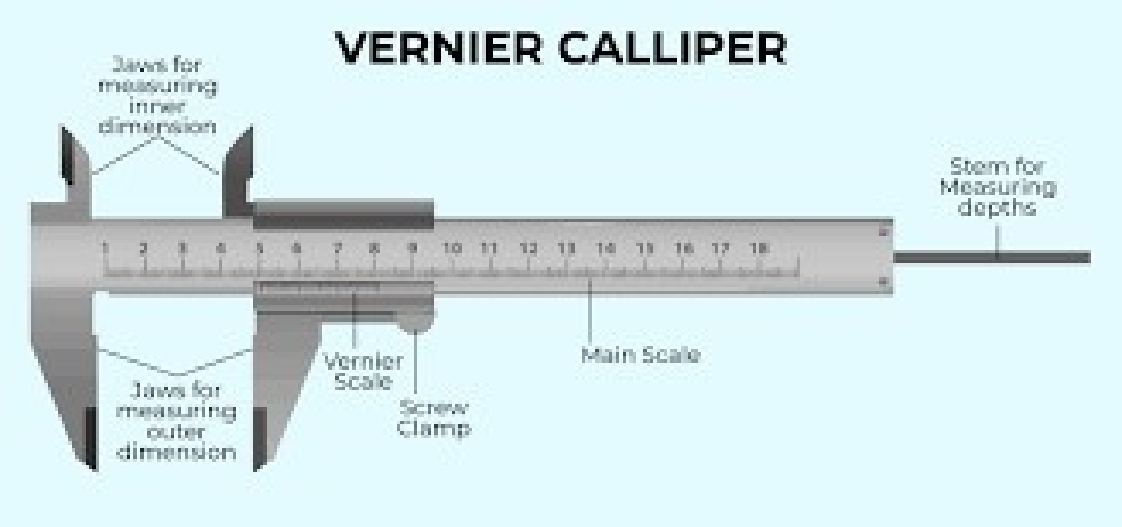
Be prepared to respond to instrument malfunctions or accidents promptly.

Follow established emergency protocols for electrical accidents.

Adhering to these procedures ensures accurate measurements, prolongs the lifespan of the instruments, and maintains a safe working environment in the laboratory.

Material handling procedures for Vernier calipers and micrometer screw gauges

Vernier Caliper:



To find the radius

T.R = M.S.R + (V.S.R. x L.C)

T.R = Total Reading

M.S.R. = Main Scale Reading

V.S.R. = Vernier Scale Reading

L.C. = Least count = 0.01cm

1. Handling:

- Hold the caliper by the frame, avoiding contact with the measuring faces.
- Use gentle pressure to avoid damaging the measuring surfaces.

2. Usage:

- Close the jaws gently on the object to be measured.
- Read the main scale and vernier scale for the measurement.

- Ensure the object is held firmly between the jaws for accurate readings.

3. Care:

- Keep the caliper clean and free from dust and debris.
- Store in a protective case or drawer when not in use to prevent damage.

4. Calibration:

- Regularly check and calibrate the caliper to ensure accuracy.
- Avoid dropping or mishandling the caliper, as it can affect its calibration.

Micrometer Screw Gauge:

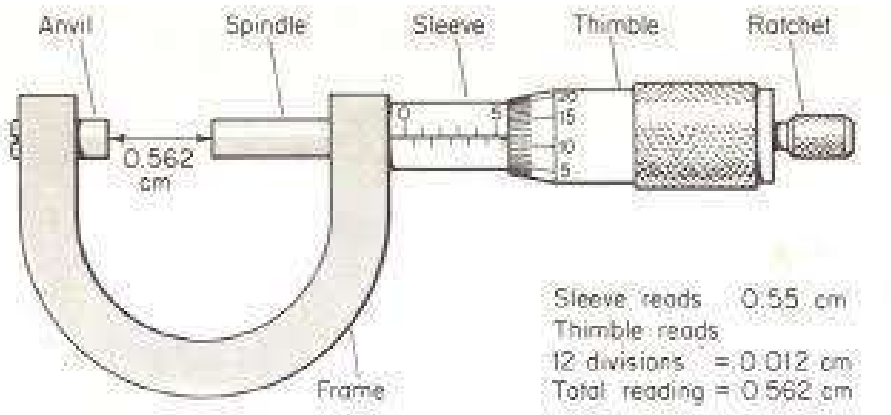


Fig. 1.6. Micrometer screw gauge

To find the radius

T.R = M.S.R + (C.S.R. x L.C)

T.R = Total Reading

M.S.R. = Main Scale Reading

C.S.R. = Circulsr Scale Reading

L.C. = Least count = 0.001cm

1. Handling:

- Hold the micrometer by the frame, avoiding contact with the measuring faces.
- Turn the thimble gently to open and close the measuring faces.

2. Usage:

- Place the object to be measured between the measuring faces.
- Turn the thimble until the measuring faces lightly touch the object.

- Read the measurement from the main scale and thimble scale.

3. Care:

- Keep the measuring faces clean and free from dirt and oil.
- Avoid over-tightening the micrometer, as it can damage the measuring faces.
- Store the micrometer in its protective case when not in use.

4. Calibration:

- Regularly check and calibrate the micrometer to ensure accuracy.
- Handle the micrometer with care to maintain its calibration.

Material Handling Procedures for Lens and Prism

1. Identification:

- Lens: Lenses are transparent optical components that refract or focus light. They come in various shapes (e.g., convex, concave) and materials (e.g., glass, plastic).
- Prism: Prisms are transparent optical elements with flat surfaces that refract and reflect light. They come in different shapes (e.g., triangular, rectangular) and configurations (e.g., right-angle, equilateral).

2. Safety Precaution:

- Wear appropriate personal protective equipment (PPE) such as gloves and safety goggles to protect against sharp edges and potential hazards.

- Handle lenses and prisms with care to avoid dropping or mishandling, which can cause damage or breakage.

3. Handling:

- Hold lenses and prisms by their edges or mounting surfaces to prevent fingerprints, scratches, or other contaminants on optical surfaces.
- Use clean, lint-free gloves when handling lenses and prisms to avoid transferring oils or dirt onto the surfaces.
- Avoid touching optical surfaces directly with bare hands, as oils and dirt can affect optical performance.

4. Cleaning:

- Use compressed air or a soft brush to remove loose particles and dust from the surfaces of lenses and prisms before cleaning.
- Clean optical surfaces gently with a lens cleaning solution and a soft, lint-free cloth or optical tissue.
- Avoid using rough or abrasive materials that can scratch or damage the surfaces.
- Clean surfaces in a well-ventilated area to prevent contamination.

5. Storage:

- Store lenses and prisms in a clean, dry environment away from direct sunlight, heat sources, and moisture.
- Use protective cases or containers to prevent dust, scratches, or other damage when not in use.
- Label storage containers clearly to identify the type, specifications, and condition of lenses and prisms.

6. Usage:

- Handle lenses and prisms carefully during installation and alignment to avoid accidental damage.
- Use appropriate mounting fixtures or holders to secure lenses and prisms in place during use.

- Follow manufacturer specifications and guidelines for handling, mounting, and usage.

7. Testing and Inspection:

- Inspect lenses and prisms for any defects, scratches, or damage before each use.
- Test optical performance using appropriate methods and equipment to ensure accuracy and reliability.
- Replace damaged or defective lenses and prisms promptly to prevent errors or inaccuracies in measurements or observations.

8. Transportation:

- Transport lenses and prisms in padded containers or protective cases to prevent damage during transit.
- Use shock-absorbent materials to cushion lenses and prisms and minimize the risk of breakage or deformation.

Material Handling Procedure for Light Emitting Diodes (LEDs)

1. Identification of LEDs:

•Physical Appearance: LEDs are small semiconductor devices that emit light when an electric current passes through them. They typically have a small, clear or colored epoxy lens covering the semiconductor die.

•Color: LEDs are available in various colors such as red, green, blue, white, and others. The color of the LED is often indicated by the color of the epoxy lens.

•Polarity: LEDs are polarized components, meaning they have an anode (+) and a cathode (-). The longer lead or the flat side of the LED indicates the positive (anode) terminal, while the shorter lead or the rounded side indicates the negative (cathode) terminal.

•Part Number: LEDs may have part numbers printed on them, indicating their specifications, such as forward voltage, forward current, luminous intensity, and viewing angle.

2. Safety Precautions:

- Wear appropriate personal protective equipment (PPE) such as gloves and safety goggles.
- Ensure the work area is clean and free from potential hazards.

3. Handling:

- Handle LEDs with care to avoid damaging the semiconductor die or the epoxy lens.
- Hold LEDs by their housing or leads, avoiding direct contact with the epoxy lens.
- Prevent electrostatic discharge (ESD) by using grounded wrist straps and handling LEDs on ESD-safe surfaces.

4. Storage:

- Store LEDs in anti-static packaging or containers to protect them from ESD.
- Keep LEDs in a clean, dry environment away from moisture, dust, and contaminants.
- Label storage containers clearly to identify LED colors and specifications.

5. Installation:

- Follow datasheet or manufacturer guidelines for proper installation of LEDs on circuit boards or other electronic devices.
- Ensure correct polarity and alignment of LED leads or terminals.
- Use appropriate soldering techniques and temperatures to solder LEDs onto circuit boards.

6. Usage:

- Observe polarity and voltage ratings as specified in the datasheet.
- Use current-limiting resistors or drivers to control the current flowing through LEDs.

- Monitor temperature to prevent overheating, which can affect LED performance and lifespan.

7. Testing and Troubleshooting:

- Use appropriate testing equipment such as multimeters or LED testers to verify LED functionality.
- Follow testing procedures outlined in datasheets or electronic test manuals.
- Take precautions to avoid damaging LEDs during testing.

8. Disposal:

- Dispose of LEDs according to local regulations and guidelines for electronic waste recycling.
- Separate LEDs from other electronic components and hazardous materials before disposal.
- Consider donating or recycling LEDs that are still functional or reusable.

Material Handling Procedure for Digital Multimeters (DMM)

DMMs are tools for measuring volts (V), ohms (Ω), and amperes (A). Most DMMs have other features and characteristics, but measuring these three variables is the foundation for all electrical measurements. You should also know the different ways DMMs display their measurements.

Measuring DC and AC Voltage

1. Select "V".
2. Plug the black test probe into the "COM" input jack. Plug the red test probe into the "V" input jack.

3. If the DMM only has manual ranging, select the highest range so as not to overload the input.
4. Touch the probe tips to the circuit across a load or power source (in parallel to the circuit).
5. View the reading, being sure to note the unit of measurement.

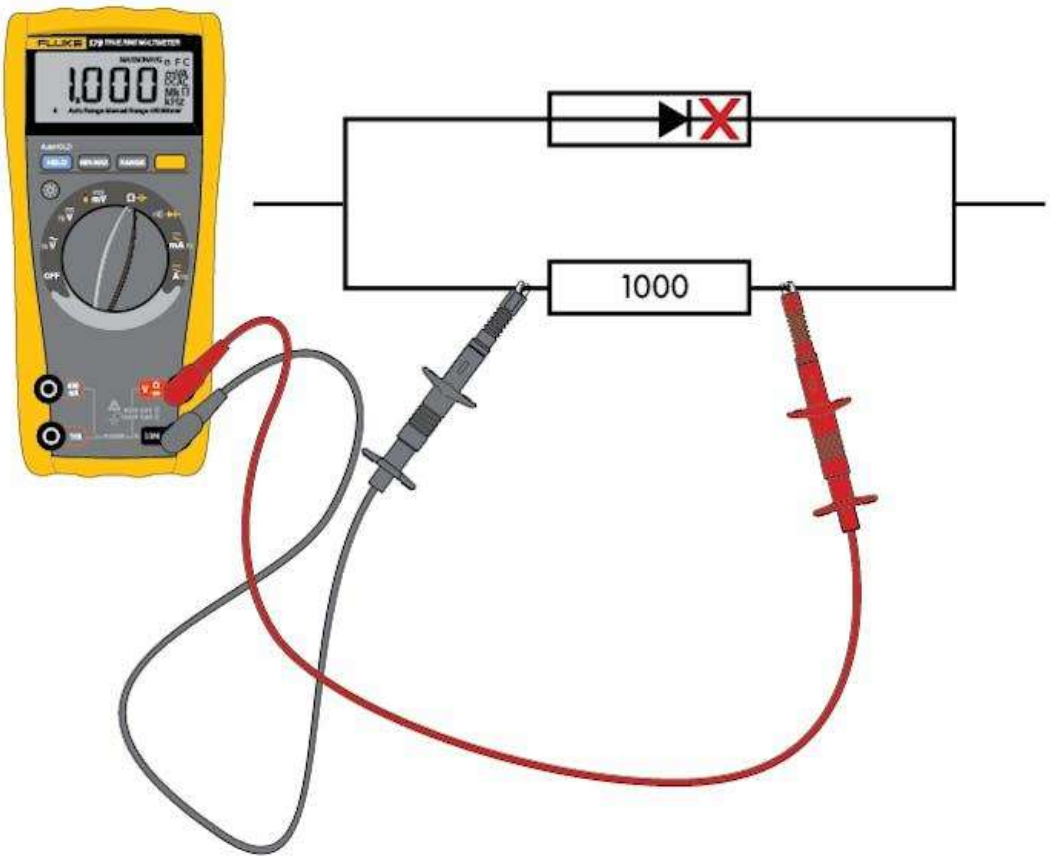
   Be careful. For DC voltage readings of the correct polarity, touch the black probe to the negative side of the circuit ground, and the red probe to the positive side of the circuit. If this gets reversed, a DMM with autopolarity will merely display a minus sign indicating negative polarity. With an analog meter, however, you risk damaging the meter.

How to Measure Resistances

1. Turn off the power to the circuit.
2. Select resistance (Ω).
3. Plug the black test probe into the "COM" input jack. Plug the red test probe into the "Ω" input jack.
4. Connect the probe tips across the component or portion of the circuit for which you want to determine resistance.
5. View the reading, being sure to note the unit of measurement—ohms (Ω), kilohms (kΩ) or megohms (MΩ).

Continuity

Continuity is a quick go/no-go resistance test that distinguishes between open and closed circuits. A DMM with a continuity beeper lets users do many continuity tests easily and quickly. The meter beeps when it detects a closed circuit, so there’s no need to look at the meter while testing. The resistance required to trigger the beeper varies from model to model of DMM.



Diodes

Diodes are like electronic switches and will turn on if the voltage exceeds a certain level—generally about 0.6V for a silicon diode—and when switched on, lets current flow in only one direction.

Many DMMs have a diode test mode. This mode measures and displays the actual voltage drop across a junction. A silicon junction should have a voltage drop of less than 0.7V when applied in the forward direction and an open circuit in the reverse direction. Be cautious when using an analog volt-ohm meter to test a diode or transistor junction. These meters can drive currents up to 50 mA through the junction, potentially damaging the unit under test.

How to Take Current Measurements

1. Turn off the power to the circuit.
2. Cut or unsolder the circuit, creating a place where the meter probes can be inserted.
3. Select A (AC) or A (DC) as desired.
4. Plug the black test probe into the "COM" input jack. Plug the red test probe into the amp or milliamp input jack, depending on the reading's expected value.
5. Connect the probe tips to the circuit across the break so that all current will flow through the DMM (a series connection).
6. Turn the circuit power back on.
7. View the reading, being sure to note the unit of measurement. If the test leads are reversed for a DC measurement, a "–" will show in the display.

Standard Operating Procedure Of Microprocessor and Microcontrollers

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COURSE OUTCOMES:

After completion of this course, the students would be able to:

CO1	Differentiate the various types of instructions and addressing modes.
CO2	Identify the Hex code/ Machine code of instructions in assembly language.
CO3	Perform interfacing of various peripheral devices and memory with microprocessor.
CO4	Demonstrate the arithmetic & Logical operation using instruction set of 8085 /8051 microprocessor.
CO5	Use of 8085/8051 for interfacing with I/O devices.
CO6	Build the assembly language programs in 8085/8051 to solve real world problems.

Microprocessor Laboratory

1. SOPs of Microprocessor Trainer Kit 8085

Name of the Lab/Facility	Microprocessor Lab
Name of the Equipment	Microprocessor Trainer Kit 8085
Purpose	To ample opportunity for the students to understand the core technology concepts, Principles, Procedure and applications of 8085 microprocessors
Scope	To main objective of this lab course is to gain hands on experience of programming the 8085 microprocessor and also on the interfacing of different peripheral to it.
Responsibility	Faculty-Lab-in-charge

STANDARD OPERATING PROCEDURE FOR MICROPROCESSOR KIT

1. Check for any visual problems in the trainer kit like loose connections.
2. Before proceeding with the lab experiments, the problem analysis and program outcomes like algorithms, flowcharts, op-code and mnemonics are required.
3. Switch ON the power supply of the Microprocessor Trainer Kit.
4. Press the RESET button.
5. Enter starting address (E.g. C000) in the kit.
6. Press the increment button before entering every instruction.
7. To fetch the result, press Execute, Increment and Reset sequentially.
8. Give the address of the input data in the corresponding address.
9. Press the Increment, Execute, reset sequentially and give output address to view the result.
10. Test the result by observing the content of various registers and memory addresses
11. After completion of the experiment Turn Off the power supply of the microprocessor kit.

PRECAUTIONS TO BE FOLLOWED

1. Do not touch or disconnect any IC's while the trainer kit is in operation.

RECORD TO BE MAINTAINED

1. Laboratory Manual containing the experiments that can be performed with the equipment
2. Maintenance Record

Microprocessor Laboratory

SOPs of DAC interface with Microprocessor Trainer Kit 8085

Name of the Lab/Facility	Microprocessor Lab
Name of the Equipment	DAC interface with Microprocessor Trainer Kit 8085
Purpose	To provide ample opportunity for the students to understand the core technology concepts, Principles, Procedure and its applications of 8085 microprocessors
Scope	To main objective of this lab course is to gain hands on experience of programming the 8085 microprocessor and also on the interfacing of different peripheral to it.
Responsibility	Faculty-Lab-in-charge

STANDARD OPERATING PROCEDURE FOR MICROPROCESSOR KIT

1. Check for any visual problems in the trainer kit like loose connections.
2. Before proceeding with the lab experiments, the problem analysis and program outcomes like algorithms, flowcharts, op-code and mnemonics are required.
3. Switch ON the power supply of the Microprocessor Trainer Kit.
4. Load data in register A.
5. Load the count and starting address of the message.
6. Get the data.
7. Display the data and wait for some time
8. Decrement count.
9. If count is zero then stop otherwise go to step 1.
10. After completion of the experiment Turn Off the power supply of the microprocessor kit.

PRECAUTIONS TO BE FOLLOWED

1. Do not touch or disconnect any IC's while the trainer kit is in operation.
2. Keys of the keyboardof the trainer should be handled softly -no hard pressing.

RECORD TO BE MAINTAINED

1. Laboratory Manual containing the experiments that can be performed with the equipment.
2. Maintenance Record

Microcontroller Laboratory

SOPs of Microcontroller Trainer Kit 8051

Name of the Lab/Facility	Microcontroller Lab
Name of the Equipment	Microcontroller Trainer Kit 8051
Purpose	To ample opportunity for the students to understand the core technology concepts, Principles, Procedure and applications of 8051 Microcontroller.
Scope	Keil development tools for the 8051 Microcontroller Architecture support every level of software developer from the professional applications engineer to the student just learning about embedded software development.
Responsibility	Faculty-Lab-in-charge

STANDARD OPERATING PROCEDURE FOR MICROPROCESSOR KIT

1. Check for any visual problems in the trainer kit like loose connections.
2. Before proceeding with the lab experiments, the problem analysis and program outcomes like algorithms, flowcharts, op-code and mnemonics are required.
3. Switch ON the power supply of the Microcontroller Trainer Kit.
4. Press the RESET button.
5. When starting a new project, simply select the microcontroller you use from the Device Database and the µVision IDE sets all compiler, assembler, linker, and memory options for you.
6. Numerous example programs are included to help you get started with the most popular embedded 8051 devices.
7. The Keil µVision Debugger accurately simulates on-chip peripherals (I^2C, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of your 8051 devices.
8. Simulation helps you understand hardware configurations and avoids time wasted on setup problems. Additionally, with simulation, you can write and test applications before target hardware is available.
9. After completion of the experiment Turn Off the power supply of the Microcontroller kit.

PRECAUTIONS TO BE FOLLOWED

1. Do not touch or disconnect any IC's while the trainer kit is in operation.

RECORD TO BE MAINTAINED

1. Laboratory Manual containing the experiments that can be performed with the equipment
2. Maintenance Record