Mihir Bhoj P.G. College

Dadri-Greater Noida (UP)

Laboratory Manual

{A Users' Guide for Laboratories}

May 2022

Botany Lab

1 Features of the Lab

1.1 Prep-room/area: The prep room/area is where chemicals and/or equipment are stored. Prior to conducting demonstrations and experiments, this is where the teacher prepares the equipment and material to be used for lab experiment(s).

1.2 Storage room or cabinet: This room or cabinet is located in the prep room/area and is used to keep dangerous/hazardous material and expensive equipment out of reach of the students. For safety purposes, the room/cabinet is properly locked, when not in use, and the keys are kept with the teacher or laboratory assistant(s).

1.3 Fire Extinguisher: A fire extinguisher is an essential component of the labs, particularly where chemicals and burners are used.

1.4 Demonstration Area: The demonstration area is located in such a way that all the students can easily see what is being demonstrated by the teacher. Therefore, this area is usually located in the front or center of the room.

1.5 Students' Work Area: These are the lab counters designed for students' use. They are usually located in a position that provides the students a good view of the teacher's work or demonstration area, and is equipped with basic laboratory equipment including sinks and storage cabinets.

1.6 Equipment: Some of the commonly used equipment in Botany lab are— Compound Microscope, Dissecting microscope, Laminar airflow chamber, Autoclave, BOD incubator and Water Bath. All equipment used in the study are periodically calibrated and maintained. Records of calibration and maintenance should is also kept.

2 Procurement of Consumables and non-consumables

At the beginning of the session, the available stock is checked and, as per the requirement, a timely purchase of glassware/chemicals and other related item is ascertained.

3 Laboratory Maintenance

3.1. Laboratory Cleaning

(i) Naturally, keeping your lab clean is the first tenet of lab maintenance. In addition, it's the simplest, cheapest, and most obvious way to keep your lab in proper shape.

(ii) The lab personnel are responsible for regular cleanliness and maintenance. They make sure to dust and wipe all the equipment at the end of the day, decontamination services are regularly used for equipment like biosafety cabinets, incubators and centrifuges.

(iii) It is advisable for the users to consult the manual or manufacturer's recommendations for proper use and upkeep of equipment. For example, certain instruments, like microscopes, require regular and thorough cleaning. By using a 70/30 mixture of ether and alcohol, we can sanitize the microscopes and prevent the spreading of harmful bacteria.

(iv) Wherever required, professional services are hired for proper maintenance and service of the equipment to avoid unpredictable complications.

3.2. Lab Equipment Calibration

(i) In most scientific industries, data is the basis of the work and in several fields, labs rely on expensive equipment to produce reliable readings. Essentially, calibration keeps them accurate and operational.

(ii) Each instrument requires to be assessed individually to find the specific calibration requirements. Essentially, it's best to consult a professional calibration service and schedule regular appointments, accordingly. Ultimately, it ensures the reliability of the equipment.

3.3. Repair of Lab Equipment

(i) As every lab employee knows, equipment breakdowns are inevitable, as no lab is immune to disorder. Unfortunately, these breakdowns are usually inconvenient and expensive.

(ii) However, it is desirable that we should not throw out the faulty equipment immediately. We should research all the relevant information about the equipment by consulting the manuals, warranty information and by contacting the manufacturer. Basically, we should explore the possibility to find out whether minor service or replacement of parts may be helpful instead of the replacement of the entire unit.

(iii) Ultimately, when it comes to disorder, we should not dispose of the equipment; rather we should find the ways to get it repaired. Microscopes, refrigerators, centrifuges and filtration systems can be repaired in simple ways without replacements.

3.4. Refurbishment

(i) When it comes to broken equipment, repairs can be a huge help. However, sometimes, refurbishment can be the best way to go. We can even sell the used equipment to earn some money back for our lab.

(ii) To refurbish the equipment, it's recommended to disassemble the unit entirely. Next, we'll need to clean each component individually. When necessary, we polish the pieces, re-lubricate moving parts and replace the pieces with visible damage.

(iii) Naturally, to properly refurbish, there are several additional factors to consider. Of course, we'll have to determine the value and selling restrictions. Additionally, the age of the equipment and functionality are important factors to consider.

3.5. Replacements

(i) Undoubtedly, no matter how stringent we are in cleaning and maintenance, replacements are sometimes necessary. Choosing replacement equipment, like freezers and refrigerators, can be a

daunting task. In many cases, the less expensive replacement models can seem like the best choice. Unfortunately, in the long term, this can actually cost our lab more. Usually, lower-cost means lower quality which implies that such equipment are more prone to disrepair.

(ii) On the other hand, high-quality equipment are more durable, and it's easier to find their spare parts for replacement. Additionally, their cleaning and maintenance is usually much easier.

3.6. Annual Maintenance Contract (AMC)

Apart from the routine maintenance of instruments, annual maintenance contract helps us in regular maintenance on affordable rates.

4. Laboratory Uses

4.1. Personnel training

Before the commencement of the session/semester, lab staff is briefed about the safety aspects to be maintained in the laboratory.

4.2. Dos and Don'ts for Students

- Do not engage in practical jokes or boisterous conduct in the laboratory;
- Never run in the laboratory;
- Keep your mobile switched off or on silence mode while in lab;
- The use of personal audio or video equipment is prohibited in the laboratory;
- The performance of unauthorized experiments is strictly forbidden;
- Do not sit on laboratory benches;
- Maintain decorum while using the lab;
- Keep your bags at the assigned place;
- Don't plug in or plug out any equipment without proper guidance of the teacher;
- Don't tamper with chemicals and equipment;
- Don't stay in the lab after your experiments;

- Keep the lab neat and clean;
- Don't litter;
- Follow the norms of 'polythene-free' campus.

4.3. Apparel in the Laboratory

- Always wear appropriate eye protection (i.e., chemical splash goggles) in the laboratory;
- Wear disposable gloves, as provided in the laboratory, when handling hazardous materials. Remove the gloves before exiting the laboratory;
- Wear a full-length, long-sleeved laboratory coat or chemical-resistant apron;
- Wear shoes that adequately cover the whole foot. Low-heeled shoes with non-slip soles are preferable. Do not wear sandals, open-toed shoes, open-backed shoes, or high-heeled shoes;
- Avoid wearing shirts exposing the torso, shorts, or short skirts; long pants that completely cover the legs are preferable.

4.4. General Work Procedure

- Always perform the experiments or work precisely as directed by your instructor;
- Immediately report any spills, accidents, or injuries to your instructor;
- Never leave experiments while in progress;
- Never attempt to catch a falling object;
- Be careful when handling hot glassware and apparatus in the laboratory. Hot glassware looks just like cold glassware;
- Never point the open end of a test tube containing a substance at yourself or others;
- Never fill a pipette using mouth suction. Always use a pipetting device;
- Make sure that no flammable solvents are in the surrounding area while lighting a flame;
- Do not leave lit burners unattended.

- Turn off all heating apparatus, gas valves, and water faucets when not in use;
- Do not remove any equipment or chemicals from the laboratory;
- Store coats, bags, and other personal items in designated areas;
- Notify your instructor of any sensitivities that you may have to any particular chemical;
- Keep the floor clear of all objects (e.g., ice, small objects, spilled liquids).

4.5. Standard Operating Procedures

Instruments should have Standard Operating Procedures (SOPs), especially for routine procedures. SOPs must be approved by the faculty.

4.6. Strategies for discard

- Keep the work area neat and free of any unnecessary objects;
- Thoroughly clean the laboratory workspace at the end of the laboratory session;
- Do not block the sink drains with debris;
- Never block access to exits or emergency equipment;
- Inspect all equipment for damage (cracks, defects, etc.) prior to use—do not use damaged equipment;
- Never pour chemical waste into sink drains or wastebaskets;
- Place chemical waste in appropriately labelled waste containers;
- Properly dispose of broken glassware and other sharp objects (e.g., syringe needles) immediately in designated containers;
- Properly dispose of weigh boats, gloves, filter paper, and paper towels in the laboratory.

Chemistry Lab

Personnel training:

In the beginning of session lab, staff is briefed about the safety aspects to be maintained in the laboratory. Key features are as below:

Dos and Don'ts for Students to Ensure Lab Safety

Conduct

- Do not engage in practical jokes or boisterous conduct in the laboratory;
- Never run in the laboratory;
- The use of personal audio or video equipment is prohibited in the laboratory;
- The performance of unauthorized experiments is strictly forbidden;
- Do not sit on laboratory benches;
- Maintain decorum while using the lab;
- Keep your bags at the assigned place;
- Don't plug in or plug out any equipment without proper guidance of the teacher;
- Don't tamper with chemicals and equipment;
- Don't stay in the lab after your experiments;
- Keep the lab neat and clean;
- Don't litter;
- Follow the norms of 'polythene-free' campus.

General Work Procedure

- Always perform the experiments or work precisely as directed by instructor;
- Immediately report any spills, accidents, or injuries to instructor;
- Never leave experiments while in progress;
- Never attempt to catch a falling object;
- Be careful when handling hot glassware and apparatus in the laboratory;
- Never point the open end of a test tube containing a substance at yourself or others;

- Never fill a pipette using mouth suction. Always use a pipetting device;
- Make sure no flammable solvents are in the surrounding area when lighting a flame;
- Do not leave lit burners unattended;
- Turn off all heating apparatus, gas valves, and water faucets when not in use;
- Do not remove any equipment or chemicals from the laboratory;
- Store coats, bags, and other personal items in designated areas;
- Notify your instructor of any sensitivities that you may have to particular chemicals;
- Keep the floor clear of all objects (e.g., ice, small objects, spilled liquids).

Housekeeping

- Keep work area neat and free of any unnecessary objects;
- Thoroughly clean laboratory work space at the end of the laboratory session;
- Do not block the sink drains with debris;
- Never block access to exits or emergency equipment;
- Inspect all equipment for damage (cracks, defects, etc.) prior to use—do not use damaged equipment;
- Never pour chemical waste into sink drains or wastebaskets;
- Place chemical waste in appropriately labelled waste containers.
- Properly dispose of broken glassware and other sharp objects (e.g., syringe needles) immediately in designated containers;
- Properly dispose of weigh boats, gloves, filter paper, and paper towels in the laboratory.

Apparel in the Laboratory

- Always wear appropriate eye protection (i.e., chemical splash goggles) in the laboratory;
- Wear disposable gloves, as provided in the laboratory, when handling hazardous materials. Remove the gloves before exiting the laboratory;

- Wear a full-length, long-sleeved laboratory coat or chemical-resistant apron;
- Wear shoes that adequately cover the whole foot. Low-heeled shoes with non-slip soles are preferable;
- Do not wear sandals, open-toed shoes, open-backed shoes, or high-heeled shoes;
- Avoid wearing shirts exposing the torso, shorts, or short skirts; long pants that completely cover the legs are preferable.

Facility & Equipment

All equipment used in the study are periodically calibrated and maintained. Records of calibration and maintenance is also kept.

Standard Operating Procedures

Instruments should have Standard Operating Procedures (SOPs), especially for routine procedures.

Stock Register and evaluation of needs during upcoming session

In the beginning of session, available stock is checked and, as per the requirement, a timely purchase of glassware/chemicals and other related item is ascertained. Apart from this, a routine maintenance of instruments is also planned. If some instruments require AMC then its annual renewal is also kept in mind.

Waste management

There are different bins for solid waste disposal. Toxic solid waste is buried in a concrete pit, effluent of chemistry lab is stored in an open big tank so that water gets evaporated, and residue is buried in concrete pit.

Zoology Lab

Personnel training:

In the beginning of the session/semester, lab staff is briefed about the safety aspects to be maintained in the laboratory. Key features are as below:

Lab Safety: Dos and Don'ts for Students

Conduct

- Do not engage in practical jokes or boisterous conduct in the laboratory;
- Never run in the laboratory;
- The use of personal audio or video equipment is prohibited in the laboratory;
- The performance of unauthorized experiments is strictly forbidden;
- Do not sit on laboratory benches;
- Do not stand on the opposite side of the table while working in the lab;
- Maintain decorum while using the lab;
- Keep your bags at the assigned place;
- Don't plug in or plug out any equipment without proper guidance of the teacher;
- Don't tamper with chemicals and equipment;
- Don't stay in the lab after your experiments;
- Keep the lab neat and clean;
- Don't litter;
- Follow the norms of 'polythene-free' campus

Animal Ethics

In 2011, the UGC imposed a partial ban on animal dissection and directed all universities and college to stop experimentation on animals for training purposes for Zoology and life sciences at the undergraduate level. In august 2014, the UGC extended the ban to post graduate level also.

General Work Procedure

- Never enter and work alone in the laboratory without prior knowledge and permission of the lab staff/faculty.
- Never use any laboratory equipment without instruction and authorization from the lab staff/faculty.
- Do not engage in any rowdy, playful, or unprofessional activities in the laboratory.
- Use all chemicals with caution. Do not taste or inhale and avoid direct touch to your skin. In case of any chemicals splashing in eyes or skin, immediately go to nearest sink, flush and wash affected place.
- Report ANY and ALL accidents, spills, BREAKAGES, or injuries to the lab staff/faculty.
- Any sharp objects like Scalpels and Razors should be used only after getting proper handling instructions and authorization from the faculty.
- Do not keep unnecessary books, backpacks and other personal items on laboratory benches.
- Avoid open long hair, flowing clothing and open-toed shoes in laboratory. Students will not be allowed to do dissections or to work with any body fluids without having a doctor's note for permission.
- Before laboratory experiments, wash hands thoroughly and line the work area with clean paper towels. After laboratory, wipe down work area with disinfectant and wash hands thoroughly.
- Dispose of used slides, chemicals, any tissue wastes or hazardous wastes in proper disposal container. Follow the instructor's advice before disposal of anything in the laboratory.
- Leave the laboratory in better condition after experiments. Put all microscopes, glass and plastic materials or others back in place properly. Clean laboratory benches, wash glass wares, slides, trays or any reusable things of such kind. Dispose specimen and others things properly.

Facility & Equipment

All equipment used in the study should be periodically calibrated and maintained. Records of calibration and maintenance should be kept.

Standard Operating Procedures

Instruments should have Standard Operating Procedures (SOPs), especially for routine procedures.

Stock Register and evaluation of needs during upcoming session

In the beginning of session, available stock is checked and, as per the requirement, a timely purchase of glassware/chemicals and other related item is ascertained. Apart from this, a routine maintenance of instruments is also carried out. If some instruments require AMC, then its annual renewal is also planned.

WASTE MANAGEMENT

Material that remains hazardous because it contains hazardous chemicals is disposed of appropriately in accordance with established norms. Thermal or chemical disinfection is followed by deposition in the Landfill.

Physics Laboratories

1 Course Goals

The goal of the Physics laboratory is to enable the students to learn the experimental procedures. As the semester/session progresses, the students will develop laboratory skills and practical understanding of various aspects of Physics as a discipline, and shall be in position to appreciate the connection between theoretical and practical knowledge of the scientific postulates. The practical/experiment sessions are conducted under the guidance of teacher(s).

2 Good Laboratory Practices

- Keeping laboratory notebooks to record the processes and findings of experiments;
- Each user is expected to read the laboratory manual prior to attending practical classes;
- Students are expected to prepare a tentative experimental procedure before class;
- Adhere to the principle of *precision* of measured quantities and their errors;
- Developing appreciation for group/collaborative work;
- Knowledge of all the apparatuses of the laboratory and their handling;
- Sharing the doubts with the peers, lab staff and teachers
- Developing the ability to establish relationship between theoretical and experimental aspects of Physics;
- Developing interest in hands-on training of various experiments;
- Developing interest in specific branch of Physics through practical sessions;
- Maintenance of cleanliness in the laboratory;
- Adherence to the standard operating procedures of the laboratory;
- Know the location of the fire extinguisher and the first aid box and how to use them in case of an emergency.

3 Conduct

- Do not engage in practical jokes or boisterous conduct in the laboratory.
- Never run in the laboratory.
- The use of personal audio or video equipment is prohibited in the laboratory.
- The performance of unauthorized experiments is strictly forbidden.
- Do not sit on laboratory benches.
- Do not stand on the opposite side of the table while working in the lab.
- Maintain decorum while using the lab
- Keep your bags at the assigned place
- Don't plug in or plug out any equipment without proper guidance of the teacher
- Don't tamper with chemicals and equipment
- Don't stay in the lab after your experiments
- Keep the lab neat and clean
- Don't litter
- Follow the norms of 'polythene-free' campus
- Food and drinks not allowed in the laboratory.
- Wear decent clothes suiting to the laboratory requirements

Computer/Mathematics Laboratory

MISSION:

- To provide quality technical education to the students through effective teaching-learning process;
- To develop students' competency through academic learning, practical and skill development programmes.
- To encourage the students to develop computational and mathematical skills;

COMPUTER LAB: DO'S AND DON'TS

Dos

- Follow the standard operating procedures while using the computer devices;
- Access the academic software/websites only;
- Shut down the computer properly before leaving the lab;
- Use authentic software/websites only;
- Follow the instructions of the teacher/instructor while using the lab;
- Read and understand how to carry out an activity thoroughly before coming to the laboratory;
- Report fires or accidents to your lecturer/laboratory assistant immediately;
- Report any broken plugs or exposed electrical wires to your lecturer/laboratory assistant immediately;
- Maintain decorum while using the lab;
- Keep your bags at the assigned place;
- Follow the norms of 'polythene-free' campus

Don'ts

- Don't access any proxy, pornographic or obscene website;
- Don't use pen drive or external hard disk without prior permission;
- Don't create any offensive file on the computer;
- Don't create any such design, wall paper, screen saver or thumbnail which may offend other users;

- Users are not allowed to do any commercial activity in the laboratory;
- Do not eat or drink in the laboratory;
- Do not engage in practical jokes or boisterous conduct in the laboratory;
- The use of personal audio or video equipment is prohibited in the laboratory;
- Avoid stepping on electrical wires or any other computer cables;
- Do not open the system/monitor unit case particularly when the power is turned on;
- Do not insert metal objects such as clips, pins and needles into the computer case or slots;
- Do not remove anything from the computer laboratory without prior permission;
- Do not touch, connect or disconnect any plug or cable without the permission of teacher/laboratory technician;
- Do not misbehave in the computer laboratory;
- Don't plug in or plug out any equipment without proper guidance of the teacher;
- Don't litter;
- Food and drinks not allowed in the laboratory.