

## MANAGEMENT AND MAINTAINENCE OF LABORATORIES

This guideline deals with maintenance and management of the equipment used in different scientific laboratories of USTM. The maintenance programme developed in the laboratory includes the following components.

1. A preventive maintenance programme for all equipment. This involves periodic performance checks as recommended by the manufacturer.
2. Maintenance of a register of all equipment indicating serial numbers, identification numbers and specific locations in the laboratory.
3. Records of all break downs.
4. Mechanism for validation of equipment.
5. Mechanism for calibration of equipment.

### ✓ **Cleaning**

Regular cleaning of lab equipment ensures that it is ready for use when needed, that stubborn stains/substances do not get a firm hold, and that experiments are not contaminated by impurities carried over from previous experiments.

It's advisable to make certain that:

- The equipment is always cleaned before and after each use.
- Cleaning reagents and cleaning aids used are specific for laboratory equipment care.
- In addition to cleaning lab equipment before and after each use, a schedule is required for more in-depth cleaning. This might involve disassembling certain machines to clean hard-to-reach parts.
- Always follow instructions from the manufacturer on cleaning policy. Certain parts of the equipment might require very specific solvents, cleaning materials, or drying procedure.

### ✓ **Calibration**

Calibration involves comparing the measurements of an equipment against the standard unit of measure, for the purpose of verifying its accuracy and making necessary adjustments. Regular calibration of laboratory equipment should be done because over time, biases develop in relation to the standard unit of measure. This guards against invalid data and ensures safety during experimentation.

Calibration should be done when;

- The recommended time by the manufacturer elapses.
- The equipment is hit by a force, dropped on the ground, or involved in any accident or an event of safety concern.
- There are unusual patterns or sounds while the equipment is in use.
- Measurements obtained are questionable.
- Highly critical measurements, where data accuracy is of utmost importance, are to be carried out.

  
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### ✓ Repairs and Refurbishments

Lab equipment is generally costly and repairs and refurbishment prolong the lifespan of equipment, saving the lab the expense of new purchases.

The following are points to consider;

- Repair and/or refurbish faulty or worn out lab equipment without any delay. Faulty machines may stop working suddenly in the middle of an experiment leading to losses and they can also be a source of safety concerns.
- Minor repairs can be done by a dedicated staff, while major repairs should be directed to specialist with knowledge on the specific machine or equipment.
- Refurbish old equipment to give them a new lease of life by cleaning thoroughly, polishing where necessary, lubricating movable parts, and replacing small worn out bits.

### ✓ Quality Replacement

Equipment that cannot be repaired or refurbished should be replaced. It is advisable to buy equipment from well known sources that can guarantee quality and offer technical support. High-quality lab equipment is easier to maintain and its durability translates to reduced costs in the long term. Non-faulty equipment that is too old should also be replaced, while some wear and tear might not be noticeable during its operation, outdated machines are not reliable and technical support in terms of servicing and acquisition of spare parts may be limited.

The care and maintenance of laboratory equipment should be a routine and embedded within the standard operating procedure of the lab. This will ensure that the life span of the equipment is prolonged and data collected within the laboratory is reliable.

### ❖ GENERAL SAFETY AND OPERATIONAL RULES OF THE LABORATORIES:

- Nonflammable, nonporous aprons offer the most satisfactory and the least expensive protection. Lab jackets or coats should have snap fasteners rather than buttons so that they can be readily removed.
- It is highly recommended that no sandals or open-toed shoes shall be worn by laboratory personnel in the laboratory.
- Mouth pipetting is never allowed.
- All electrical equipment shall be properly grounded.
- Glass breakage is a common cause of injuries in laboratories. Only glass in good condition should be used.
- Clean all glassware before sending for repair. Glassware that has been in contact with infectious agents shall be disinfected before disposal or repair.
- Protect hands with leather gloves when inserting glass tubing. Hold elbows close to the body to limit movement when handling tubing.
- Conventional laboratory glassware must never be pressurized or used with vacuum.
- Stored items or equipment shall not block access to the fire extinguisher(s), safety equipment, or other emergency items.
- Eating or drinking within laboratories is not permitted.
- No food or beverage may be stored in the cold rooms/Laboratory refrigerators and freezers.

- Working with potentially harmful chemicals is an everyday occurrence in a laboratory. Employees are requested to inform themselves about toxicological information and procedures for handling and storage of chemicals used.
- In case of minor injury, use **first aid** items available in the lab.
- In case of serious injury, **medical treatment** has to be taken.

## 1. BOTANY LABORATORY

### Basic Working Principles in Bio-safety laboratories:

- ✓ The primary principle of biological safety is containment. This refers to a series of safety procedures which have to be conducted to reduce or eliminate human and environmental exposure to potentially harmful biological agents. While working in laboratories one might handle specimens, cultures and agents without full knowledge of the biohazard risk; these materials may contain infectious agents. While working in any of the above defined bio-safety levels it is required of any personnel at to follow the regulations listed below:

#### A. Wash your hands thoroughly:

- Before and after working with any biohazard
- After removing gloves, laboratory coat, and other contaminated protective clothing
- Before eating, drinking, smoking, or applying cosmetics
- Before leaving the laboratory area
- Do not touch your face when handling biological material
- Never eat, drink, smoke, or apply cosmetics in the work Area

#### B. Handling Procedures liquid infectious materials:

- Use mechanical pipetting device (examples; pipette aid, pipetteman or bulb).
- Minimize aerosol generation.
- Add disinfectant to water baths for infectious substances.
- Use only closed tubes for centrifuging procedures. Inspect the tubes before use.

## 2. CHEMISTRY LABORATORY

### 1. General Laboratory Safety Procedures

#### DO

- Know the potential hazards of the materials used in the laboratory. Review the Safety Data Sheet (SDS) and container label prior to using a chemical.
- Know the location of safety equipment such as telephones, emergency call numbers, emergency showers, eyewashes, fire extinguishers, fire alarms, first aid kits, and spill kits which can be found on all campuses.
- Review your laboratory's emergency procedures with your Principal Investigator, Lab Supervisor, or Lab Manager to ensure that necessary supplies and equipment are available for responding to laboratory accidents.

  
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- Practice good housekeeping to minimize unsafe work conditions such as obstructed exits and safety equipment, cluttered benches and hoods, and accumulated chemical waste.
- Wear the appropriate personal protective apparel for the chemicals you are working with. This includes eye protection, lab coat, gloves, and appropriate foot protection (no sandals or open toed shoes). Gloves must be made of a material known to be resistant to permeation by the chemical in use.
- Shoes must cover the entire foot. Open toed shoes and sandals are inappropriate footwear in laboratories. Fabric and athletic shoes offer little or no protection from chemical spills. Leather shoes with slip-resistant soles are recommended.
- Always wear appropriate lab clothes and gloves when working with biological agents. Wear gloves over gown cuffs. Do not wear potentially contaminated clothing outside the laboratory area.
  - Never wear contact lenses when dealing with infectious agents.
  - Additional appropriate protective clothing should be selected and worn based upon the task and degree of exposure anticipated.
- Label all new chemical containers with the "date received" and "date opened."
- Label and store chemicals properly. All chemical containers must be labeled to identify the container contents (no abbreviations or formulas) and should identify hazard information. Chemicals must be stored by hazard groups and chemical compatibilities.
- Use break-resistant bottle carriers when transporting chemicals in glass containers that are greater than 500 milliliters. Use lab carts for multiple containers. Do not use unstable carts.
- Use fume hoods when processes or experiments may result in the release of toxic or flammable vapors, fumes, or dusts.
- Restrain and confine long hair and loose clothing. Pony tails and scarves used to control hair must not present a loose tail that could catch fire or get caught in moving parts of machinery.

## 2. Procedures for Proper Labeling, Storage, and Management of Chemicals

Proper labeling of the chemicals and storage is essential for a safe laboratory work environment. Inappropriate storage of incompatible or unknown chemicals can lead to spontaneous fire and explosions with the associated release of toxic gases. To minimize these hazards, chemicals in the laboratory must be segregated properly.

### Safety Data Sheets

Safety Data Sheets (SDS) for all laboratory chemicals are required to be maintained in the laboratory.

- The SDS for the exact chemical or mixture provided by the manufacturer of the product must be available. The chemical identity and manufacturer found on the label must match the chemical identity and manufacturer found on the SDS.
- All personnel must know how to access the SDS whether they are maintained on paper or electronically.
- All personnel must know how to read and understand an SDS.

  
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- ❖ Proper and safe measurement should be taken for storing and handling of the chemicals used in the laboratory should be maintained.
  - o Flammable/Combustible Liquids
  - o Flammable Solids
  - o Inorganic Acids
  - o Organic Acids
  - o Oxidizing Acids (Nitric, etc.)
  - o Caustics (Bases)
  - o Oxidizers
  - o Water Reactives
  - o Air Reactives
  - o Unstable (shock-sensitive, explosive)
  - o Carcinogens & Reproductive Toxins
  - o Toxins, Poisons
  - o Non-Toxics
  - o Compressed Gases
  - o Gases: Toxic Gases, Flammable Gases, Oxidizing Gases, Corrosive Gases, Inert Gases
  - o Cryogenic Liquids

### 3. GEOGRAPHY LABORATORY

Geography lab consists of three rooms, One AC room i.e, *GIS lab* with 30 computers and server for GIS practical and two *Cartographic labs* with 10 Aerial Photographs, 05 Satellite Imagery, 30 handheld GPS receivers along with different survey instruments for surveying. Other equipments include planimeter, rotameter, barometer, thermometer, wind vane and rain gauge. There is a Map Library consisting of 30 Survey of India topographic sheets on different scales covering different areas of the country and 05 weather maps. The lab is equipped with 10 tracing table for students. The Labs are also equipped with software in Remote Sensing, Digital Image Analysis and Geographical Information System. The various software available includes: ARC GIS 10.1, QGIS 3.4, SAGA 6.4, installed in 31 desktop.

Equipment maintenance is one important aspect of quality assurance in the laboratory. Accuracy of a report/data depends partly on error free machines. Laboratory equipments are also costly items. Daily routine procedures in maintenance can help to increase the life span of the equipment thereby preventing unnecessary burdens on the finances. Faulty equipment can also be unsafe for the users.

  
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Special care for laboratory and equipments were taken for maintenance like:

- Cleaning of laboratory daily properly by non teaching staffs.
- Cleaning of all equipment in a week.
- We consult manual before cleaning.
- Cleaning of some instruments by qualified professionals.

We calibrate our instruments to maintain accuracy of data.

- We carry out an inventory of our equipment and decide which is most suitable for which practical– from basic preventative maintenance to more advanced accuracy verification.
- Regularly we calibrate equipment for ongoing preventative maintenance that will keep our lab sharp.

**Some important rules in all the laboratories are:**

Prior permission of the concerned faculty is mandatory for working in this laboratory. However, scheduled classes can continue under the supervision of the concerned faculty member.

- Students found mishandling the computer systems or peripherals would be penalized with a monetary fine.
- Food and /or beverages are strictly prohibited inside the GIS laboratory.
- Students should log off before switching off the computers.
- Students should leave the computer laboratory only after switching off the computer.
- Students should not use the CD/DVD drive, pen-drive in the computer, data and maps are provided to the students through server by faculties.
- Students Must Use Mouse Pads
- Students should not fiddle with the 'Control Panel' installed in the Computers.
- Use tracing boards for tracing patterns.
- Students are not allowed to avail the Internet facility inside the computer laboratory for personal use.
- Students are not permitted to use the computers for playing games.
- Students should take off their shoes and put them on the rack provided outside the laboratory before entering the computer laboratory.
- Use of Mobile Phones is strictly forbidden inside the Computer Laboratory.
- Ensure that all lights, AC and fans are switched off after the class.
- Students keep their bags on the rack provided.

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