NEHRU COLLEGE OF PHARMACY

Approved by Pharmacy Council of India & AICTE, New Delhi,
Affiliated to Kerala University of Health Sciences & Directorate of Medical Education (DME), Kerala
Recognized by UGC under section 2(f) of the UGC act 1956,
(An ISO 9001-2015 Certified Institution)
Nila Gardens, Pampady, Thiruvilwamala, Thrissur Dist. – 680 588, Kerala

SAFETY MANUAL

NEHRU GROUP OF INSTITUTIONS
TAMILNADU • KERALA
ISO 14001-2004 CERTIFIED INSTITUTIONS
Moulding True Citizens

NEHRU COLLEGE OF PHARMACY

Pampady, Thiruvilwamala, Thrissur (Dt)-680588

Moulding True Citizens

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CHAPTER 1
PREFACE

Nehru College of Pharmacy,(NCP) Pampady, Thrissur, is one of premium institutions under Nehru College of Educational and Charitable Trust, affiliated to the Kerala University of Health Sciences, Thrissur, Kerala and is approved by Pharmacy Council of India (PCI),New Delhi.

Healthy and safety environments are inevitable to conduct all Educational, Research, Service and campus activities in any institutions. This Health and Safety manual is aiming the safe and secure campus life in Nehru College of Pharmacy. This manual provides the standard guidelines for students, faculty, staff and the public who come into the premises of college to keep accidents to a minimum.

Please take few minutes to read the contents of this manual and decide which part you need to read and understand for your safety and the safety of others with whom you are working.

CHAPTER 2
NATIONAL SAFETY AND HEALTH PLEADGE

–On this day, I solemnly confirms that I will rededicate myself to the cause of Safety, Health and protection of Environment and will do my best to observe rules, regulations & procedures and develop attitude & habits conducive for achieving these objectives.

I fully realize that accidents and diseases are a drain on the national economy and may lead to disablements, deaths, harm to health and damage to property, social suffering andgeneral degradation of environment.

I will do everything possible for the prevention of accidents and occupational diseases and protection of environment in the interest of self, family, community, organization and the nation at large‖.

-National Safety Council.

CHAPTER 3
RESPONSIBILITIES OF COMMITTEE

Table 1. Responsibilities of committee

Responsibility	Detailed Tasks
Traffic & outdoor safety	❖ Prepare guidelines for outdoor pedestrian as well as vehicular traffic ❖ Monitoring and ensuring safety as per guidelines ❖ Conduct traffic surveys and update guidelines periodically ❖ Predict traffic surveys in special days in the campus and prepare temporary guidelines ❖ Annual testing and maintenance of outdoor facilities (hand rail, markings, signboard, pathways etc.) ❖ Ensure availability of Emergency medicines at security checkpoints ❖ Give training for outdoor staff for handling emergency situations ❖ Ensure temperature test and proper visitor‘s diary in checkpoints
Indoor safety	❖ Prepare guidelines for indoor occupancy in class rooms and each laboratory separately ❖ Monitoring and ensuring safety as per guidelines ❖ Conduct mock drill and update guidelines periodically ❖ Predict rush in special days in the building and prepare temporary guidelines ❖ Annual testing and maintenance of indoor facilities (hand rail, electrical wirings and fittings, signboards, staircase etc.) ❖ Ensure availability of Emergency medicines at each floor ❖ Give training for outdoor staff for handling emergency situations ❖ Ensure proper sanitization periodically
Emergency management	❖ Display emergency contact numbers in each and every corner ❖ Training of special team from campus for managing the situations ❖ Give awareness classes or mock drill periodically ❖ Prepare analysis report on each and every incidents in the campus which is related to safety directly or indirectly ❖ Develop and review risk related policies & procedures ❖ Develop and implement wellness activities to the community Report all potential & actual claims to the insurance
Fire protection	❖ Attend to Life Safety and Fire issues throughout NCP ❖ Conduct annual fire safety round ❖ Initiate steps to maintain the fire extinguishers in time
General	❖ Revise Safety Manual by incorporating the updated safety rules and procedures ❖ Prepare annual report of all activities of Committee

CHAPTER 4
SCOPE OF THE SAFETY MANUAL

The Scope of this Safety Manual is to ensure that institutional policies and procedures relating to the safe conduct of academic and non-academic activities are followed. These policies and procedures are used as a foundation for academic safety and environmental health programs throughout departments of Nehru College of Pharmacy. The Safety Manual for the college is prepared considering the various activities in each department & laboratories and facilities, with an aim to promote safety awareness aspects and precautions to be taken by the entire staff and students.

CHAPTER 5
GENERAL SAFETY GUIDE LINES

General Safety Guidelines apply to all the departments, laboratories, workshops and other facilities of Nehru College of Pharmacy.

5.1 Safety, Productivity and Reliability

Any organization should use the available resources optimally. On the resources, human resource is the most important one. Safety practices are aimed at preventing accidentswhich cause injury to the persons and damage to the properties. Safety, Productivity and Reliability are closely linked.

Accidents invariably cause some kind of damage – injury to the personnel and/or damage to property. However, accidents are preventable, if proper care is taken in the safety guidelines for any kind of activity. Unsafe conditions and unsafe acts during a particular work cause accidents. These can be avoided by ensuring:

- Safe working conditions.
- Use of Personnel Protective Equipment .(PPE)
- Proper maintenance of tools and equipment.
- Properly planned work.
- Application of the general and special safety instructions by the workers.
- Immediate steps to correct any violation of safety rules
- Pro-active / Remedial action against Safety rules violators

CHAPTER 6
SAFETY POLICY & SAFETY COMMITTEE OF NCP

The safety committee of NCP Campus constituted as per the instructions from the. The members of the committee are

1. Dr. Raveendran. K.C - Prof Chemistry
2. Dr.D Shudhahar - Prof. Chemistry
3. Mrs. Anjali Nair - Asso. Prof Pharmacology Dept.
4. Ms. Sreelakshmi - Asst. Prof. Pharmacognosy Dept.
5. Mrs. Sreelekha - Asst. Prof. Pharmacy Practice Dept.
6. Mr. Valli Manalan - Prof Pharmaceutics Dept.
7. Mr. Govindraj - Assistant Office Superintendent , NCP
8. Mr. Rakesh -Civil supervisor

SAFETY POLICY OF NCP

NCP safety policy is to provide and promote a healthy and safe working environment for the members of its staff, students and visitors as far as that is reasonably practicable

Implementation of Safety Policy:

- The College considers that high standards of safety and health are integral part of the effective management in NCP College.
- The college is committed to plan, review and development of safety and health arrangements in order to achieve a continual improvement in performance
- The Principal will ensure that appropriate personnel are appointed to assist in the formation, implementation and development of safety policy.

Awareness on safety and health shall be given to all staff and students. Specific training shall be given to all engaged in specific safety duties. This is essential for the smooth and safe running of the College. All staff, students and others working in the College are expected to co-operate on safety aspects within the College. Everyone should take reasonable care for their own safety and health and that of others who may be affected by their activities. It is also important to inform their immediate reporting authority or Safety Committee members, if any unsafe situations are noticed that could give rise to serious or impending danger.

CHAPTER 7
SAFETY OBJECTIVES

- Transport and car parking safety
- Campus visitor‘s safety
- Staff and student‘s safety
- Equipment safety
- Playground safety
- Special day celebration safety

CHAPTER 8
SAFETY INSPECTION

Safety inspection is a useful tool in any accident prevention program. Its primary aim is to locate and report potential hazards existing in a workplace that can adversely affect safety, environment and health of workers.

Types of Inspections:

The following are various types of inspections for ensuring a safe working environment.

1. Quarterly Safety Performance Appraisal and Safety Inspection
2. Safety Implementation Committee Inspection
3. Annual Area Safety Inspection
4. Annual Electrical Safety Inspection

Quarterly Safety Performance Appraisal and Safety Inspection

This is to be carried out by the safety committee in the College for the respective labs and departments once in 6 months.

The topics to be covered in the Quarterly Safety Performance Report and Quarterly Safety Inspection Report are as given below:

Topics to be covered in Safety Performance Report

1) Safety procedures: Formulated for new activities, revised and updated for existing activities, briefing to staff members, documentation of, circulation of, etc.
2) Safety education/Training: Details as to the number of staff got trained, field of training, where trained, usefulness of the training etc.
3) Observance of Safety Rules/Procedures: Specific areas or particular persons who will strictly adhere and habitually observe safety rules/procedures.
4) Safety Inspection: Areas where safety rule/procedures are violated and safety

lapses are observed and the various types of violation and lapses.

5) Personal Protective Equipment: Availability in quality and quantity, any new type of Equipment added during the quarter, any difficulty/inconvenience experienced by the user, any modification needed etc, are periodic checking being done and defective one replaced etc.
6) Safety Engineering control systems: are they adequate to meet the safety requirements, any new systems added, any system found defective and as suchnot effective, any modification suggested/ done to improve the efficiency etc.) Safety clearances:

List of items/areas to be inspected

1) Environmental factors: Illumination, ventilation, dusts, gases, sprays, vapors, fumes, noise, heat radiation/ other high energy radiation etc.
2) Power source equipment: Steam and gas engines, electrical motors etc.
3) Electrical equipment: Switches, fuses, breakers, outlets, cables, extensions and fixtures, cords, ground connectors, connections etc.
4) Hand tools Wrenches, screw drivers, hammers, power tools etc
5) Personnel Protective Equipment (PPE): Hard hats, safety goggles, safety shoes, coveralls, aprons, respirators, gas masks, earmuffs etc.
6) Personal Service and First Aid Facilities: Washbasins, safety showers, eye wash fountains, first aid boxes, stretchers etc.
7) Fire Protection and Extinguishing Equipment: Smoke detectors, fire alarms, water tankers, sprinklers, deluges, extinguishers, Fire hydrants, Fire hoses, fire buckets etc.
8) Walkways and Roadways: Ramps, doorways, corridors, sidewalks, walkways, aisles, vehicle ways, fire exits, fire escapes etc.
9) Containers: Scrap bins, disposal receptacles, empty boxes, carboys, barrels, drums, gas cylinders, solvent cans, drums etc.
10) Warning and Signaling Devices: Warning signs, warning boards, safety displays safety alarms, fire bells, sirens etc.
11) Structural Sparing: Windows, doors, stairways, sumps, shafts, pits, floor openings etc.

12) Miscellaneous: Any item that does not fit in any of the preceding/aforementioned categories.

Annual Electrical Safety Inspection

Separate annual inspections of electrical installations shall be carried out by Electrical Maintenance Sections of the Engineering wing. Unsafe conditions/acts pertaining to electrical safety are brought out in this report. In addition to this, inspection of areas handling explosives and other hazardous substances are conducted by the Electrical Safety Officer and consolidated report will be sent to principal.

CHAPTER 9
ACCIDENTS TYPES

Accidents are classified into five classes:

Class 1: Accidents resulting in non-disabling injury or accidentsClass

2: Accidents resulting in temporary disability or accidents

Class 3: Accidents causing injury resulting in permanent partial disability

Class 4: Accidents causing disabling injury resulting in permanent total disability

Class 5: Accidents causing death or accidents

ACTIONS NEEDED WHEN AN ACCIDENT TAKES PLACE

There are mainly four actions needed when an accident take place in the campus. They areImmediate Action, Follow-up Action, Reporting Procedure and Investigation of Accidents

Immediate Action

Safety Officer, with the help of the safety group, shall take immediate action to get quick medical attention to the injured. Also will have to take action to report and record the evidence for the major purpose of incident investigation.

Following are the actions to be taken immediately after an incident.

1) First Aid to be provided to the Injured Person by a trained first aider immediately. After the first aid, the injured to be sent to the nearest Medical Centre.
2) The Medical Centre has to alert properly to receive the injured for immediate treatment. If the injured is found not fit condition to be transported, the Medical Team have to call to the accident site for urgent treatment.
3) The site is cordoned off immediately.
4) The site and important evidences are to be photographed for future formalities.
5) The concerned authorities (as given in the flow chart) are intimatedof the accident over phone or through a messenger, immediately.
6) A First Information Report (FIR) has to send to the concerned authorities

7) A list of damaged materials to be made and to assess the loss incurred

Follow-up Action

After completing the immediate actions, the safety officer will take the follow up actions which will ensure the information required for the Accident Report to be provided to CSC.

1) The event is classified into one of the five classes as described earlier.
2) An Accident Report as per specified Format is prepared and shall send to the authorities concerned.
3) An Investigation Committee shall be constituted by principal as early as possible i.e. Within 48 hours of the event in any case.

Reporting Procedure

Any person involved in/witnessing/noticing any accident or near-accident shall immediately report the same by telephone/messenger or any other suitable means to the safety Officer and Head of the Department concerned. The report shall contain the following information in brief:

1. Location, Date, Time of Incident
2. Type of accident in brief
3. Name of the person injured
4. Nature of injury, if any
5. Damage to the property, if any

Head of the Department and safety officer on receipt of the information shall take necessary actions to give medical aid to the injured. Appropriate actions shall be done to send, First Information Report and Accident Report to Principal.

Investigation of Accidents

All accidents shall be investigated as early as possible. The primary objective of the investigation should be focused to establish the cause of the accident and recommending suitable precautionary measures to avoid recurrence of the same.

CHAPTER 10 EMERGENCY PROCEDURES

10.1. INTRODCTION

During the course of normal operations there is always a chance for an emergency situation to arise. These emergencies can be the result of a fire, chemical exposure, chemical spill, or the need for medical assistance. In case of an emergency, the Emergency Response Plan should be implemented. This plan would include evacuation of the persons / facility if deemed appropriate.

Internal effective communication is very important during any emergency situation. It is essential that all employees and students should know, how to act and react during the emergency. To accomplish this, it is necessary that a written Emergency Response Plan to be developed and that all employees are shall trained on how to act accordingly. All accidents, regardless of severity, should be reported and investigated.

10.2. FIRES

10.2.1 BUILDING FIRES

The following steps are recommended if a fire occurs in a building:

- Initiate a building evacuation using the emergency alarm.
- If the fire is small and you have been trained in the use of portable fire extinguishers, you may attempt to extinguish the fire. Fight against the fire, from a position where you can escape.
- If your clothing catches fire, drop down to the floor and roll to smother the fire. Ifa co-worker‘s clothing catches fire, insist him to lay down on to the floor and rollhim or her to put off the flames. Use a safety shower immediately thereafter.
- Use the nearest Fire exit way to evacuate from the building. Close all the doorsto the passage to prevent the spread of smoke and fire.
- After exiting, immediately proceed to a safe location at least 30 meters away fromthe building.
- Do not re-enter the building until the all clear is given by the fire department.

10.2.2 LABORATORY FIRES

Fires are a common emergency in any laboratory and specifically in a laboratory with flammable materials. In the event of a fire, do the following things:

- Assist any person in immediate danger to safety, if it can be accomplished without risk to you.
- Immediately activate the building fire alarm system.
- If the fire is small and trained people have to use of portable fire extinguishers,

- Don‘t fight the fire if either of these conditions exists: The fire is too large or outof control. The atmosphere is toxic.
- If first attempts to put out the fire do not succeed, evacuate the building immediately.
- Doors, and if possible, windows, should be closed as the last person leaves a room or area of a laboratory.
- When they hear the fire alarm sound, all personnel in the affected areas shall evacuate the building immediately.
- Upon evacuating the building, personnel shall proceed to a designated area at least 50 meters away from the affected building.
- No personnel will be allowed to re-enter the building without permission. You must report all fires to your supervisor.

10.2.3 FIRE SAFETY REMINDERS

- Never use an elevator if the building fire alarm is activated.
- Use stairwells to evacuate the building. Be aware of your egress routes.
- Never block open corridor/hallway doors in a building.
- Check all appliances in your office before leaving. Turn them off.
- Use electrical extension cords properly. Examine the cords periodically for safe service.

10.3. CHEMICAL EXPOSURES

The following procedures should be followed in the event of a chemical exposure. In all cases the incident should be reported to your laboratory chief, technician or principal investigator, regardless of severity.

CHEMICALS ON SKIN OR CLOTHING

- Immediately flush with water for no less than 15 minutes (except for hydrofluoric acid).
- While rinsing, quickly remove all contaminated clothing or jewellery.
- Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes.
- Check the MSDS (Material Safety Data Sheet) to determine if any delayed effects should be expected.
- Discard contaminated clothing or launder them separately from other clothing..
- **Do not use solvents to wash skin**. They remove the natural protective oils from the skin and can cause irritation and inflammation. In some cases, washing with a solvent may facilitate absorption of a toxic chemical.
- **For flammable solids on skin**, first brush off as much of the solid as possible, then proceed as described above.
- **For hydrofluoric acid**, rinse with water for 5 minutes and apply calcium gluconate gel, then get immediate medical attention. If no gel is available, rinse for 15 minutes and consult a doctor immediately.

CHEMICALS ON EYES

- Immediately flush eye(s) with water for at least fifteen minutes. The eyes must be forcibly held open to wash, and the eyeballs must be rotated so all surface area is rinsed.
- Remove contact lenses while rinsing. **Do not lose time removing contact lenses before rinsing**. Do not attempt to reinsert contact lenses.
- Seek medical attention regardless of the severity or apparent lack of severity. Contact for an ambulance or transportation to a health center if it is needed. Explain carefully what chemicals were involved.

CHEMICAL INHALATION

- Close containers, open windows or otherwise increase ventilation, and circulate fresh air.
- If symptoms, such as headaches, nose or throat irritation, dizziness, or drowsiness persist, seek medical attention by calling emergency or going to a health center. Explain carefully what chemicals were involved.
- Review the MSDS to determine what health effects are expected, including delayed effects.

ACCIDENT INGESTION OF CHEMICALS

- Immediately go to a health center or contact Ambulance at 108 for instructions.
- Do not induce vomiting unless directed to do so by a health care provider.

ACCIDENT INJECTION OF CHEMICALS

Wash the area with soap and water and seek medical attention, if necessary immediately go to a health center or contact Ambulance at 108. Explain carefully what chemicals were involved.

10.4. CHEMICAL SPILLS

All chemical spills, regardless of size, shall be reported in writing to your supervisor. The report shall include the date, time, location, chemical(s) and their volume, and names of all persons involved, including any visitors who were exposed and personnel involved in the cleanup.

10.5. EMERGENCY SPILLS

Chemical spill is classified as an Emergency Spill whenever it:

- Causes personal injury or chemical exposure that requires medical attention.
- Causes a fire hazard or uncontrollable volatility
- Requires a need for breathing apparatus of the supplied air or self-contained type

- Involves or contaminates a public area
- Causes airborne contamination that requires local or building evacuation
- Causes a spill that cannot be controlled or isolated by laboratory personnel
- Causes damage to college property that will require repairs
- Involves any quantity of metallic mercury
- Cannot be properly handled due to lack of local trained personnel and/or equipment to perform a safe, effective cleanup
- Requires prolonged or overnight cleanup
- Involves an unknown substance.

The following tactics are prioritized in terms of usual preferred action sequences. However, each spill incident is unique and involves persons with varying levels of spill expertise and experience. Thus, for any individual incident, isolation of the spill and/or securing the area might best occur prior to or simultaneously with contacting Police/Fire by dialing 100 /101. The following general procedures should be used for all emergency spills:

- Contact the Campus Security for Assistance. Notify the police dispatcher of location of the spill and, if known, the chemical spilled.
- If the spill presents an immediate danger, leave the spill site and warn others, control entry to the spill site.
- Remove contaminated clothing. Flush skin/eyes with water at least 15 to 30 minutes; use soap for intermediate and final cleaning of skin areas.
- Protect yourself, and then remove injured person(s) to fresh air, if safe to do so.
- Notify nearby persons and evacuate as necessary. Prevent entry, as necessary, by posting a guard in a safe area and/or shutting doors./ fencing with guardrails.
- If flammable vapors are involved, do not operate electrical switches unless to turn off motorized equipment. Try to turn off or remove heat sources, where safetodo so.
- If the substance involved is an unknown, then emergency spill response procedures are limited to self-protection, notification of Campus Security for response, isolation of the chemical, evacuating and securing the area involved.
- Do not touch the spill without protective clothing./ Use Gloves as it deemed so
- Where the spill does not present immediate personal danger, try to control the spread or volume of the spill. This could mean shutting a door, moving nearby equipment to prevent further contamination, repositioning an overturned container or one that has a hole in the bottom or side, creating a dike by puttinganabsorbent around a spill or opening the sashes on the fume hoods to facilitate removal of vapors.
- Never assume gases or vapors do not exist or are harmless because of lack of smell.
- Increase ventilation by opening closed fume hood sashes to the 12 inch or full

open position. Exterior doors may be opened to ventilate non-toxic vapors.

- Use absorbents to collect substances. Reduce vapor concentrations by covering the surface of a liquid spill with absorbent. Control enlargement of the spill area by confining with absorbent.

10.6. MINOR SPILLS

Minor spills are those spills that do not fit the requirements for Emergency Spills. The following general procedures should be used for all minor spills:

- Attend to any persons who may have been contaminated. If these persons require medical attention this is an Emergency Spill (see above).
- Notify persons in the immediate area about the spill.
- Evacuate all nonessential personnel from the spill area.
- If the spilled material is flammable, turn off ignition and heat sources.
- Avoid breathing vapors of the spilled material. If respiratory protection is necessary this is an Emergency Spill (see above).
- Leave on or establish exhaust ventilation if it is safe to do so.
- Secure supplies to effect cleanup.
- Put on appropriate personnel protective equipment.
- Spilled Liquids:
- Confine or contain the spill to a small area. Do not let it spread.

For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., soda ash or liatomaceous earth). For small quantities of other materials absorb the spill with a noncreative material (such as vermiculite, clay, dry sand, or towels).

- For larger amounts of inorganic acids and bases, flush with large amounts of water (providing the water will not cause additional damage). Flooding is not recommended in store rooms where violent spattering may cause additional hazards or in areas where water-reactive chemicals may be present.
- Carefully pick up and clean any cartons or bottles that have been splashed or immersed.
- Generally, sweep spilled solids into a dustpan and places them into a container suitable for that chemical.
- Dispose of residues according to safe disposal procedures. Remembering that personal protective equipment, brooms, dustpans, and other items may require special disposal procedures.

10.7. MERCURY HANDLING AND SPILL CLEAN UP

Storage and handling

- Always store mercury in unbreakable containers and stored in a well- ventilated area.
- When breakage of instruments or apparatus containing mercury is a possibility,
- The equipment should be placed in an enameled or plastic tray or pan that can be cleaned easily and is large enough to contain the mercury.
- Transfers of mercury from one container to another should be carried out in a hood, over a tray or pan to confine any spills.
- If at all possible, the use of mercury thermometers should be avoided. If a mercury thermometer is required, many are now available with a Teflon coating that will prevent shattering.
- Always wash hands after handling mercury.

Protective Clothing

For small spills, a laboratory coat, safety glasses, and gloves should be used. Gloves made of the following have been rated as excellent for protection against elemental mercury:

- Chlorinated polyethylene (CPE)
- Polyvinyl Chloride (PVC)
- Polyurethane
- Nitrile Rubber (also known by several brand names)
- Butyl Rubber
- Neoprene

If mercury has been spilled on the floor, the workers involved in cleanup and decontamination should wear plastic shoe covers. Laboratory Superintendent or Tradesman should be called immediately if a spill is extensive enough to require workersto kneel or sit where mercury has been spilled since impermeable clothing will be required.

Spill Kit

If a spill kit is purchased, follow the manufacturer's directions. Protective gloves

- Mercury suction pump or disposable pipettes to recover small droplets elemental zinc powder
- Dilute sulphuric acid (5-10%) in spray bottle
- Sponge
- Plastic trash bag
- Plastic container
- Plastic sealed vial for recovered mercury

Clean Up Procedures

- Wearing protective clothing, pools and droplets of metallic mercury can be pushed together and then collected by a suction pump.
- After the gross contamination has been removed, sprinkler the entire area with zinc powder. Spray the zinc with the dilute sulphuric acid.
- Using the sponge, work the zinc powder/sulphuric acid into a paste consistency while scrubbing the contaminated surface and cracks or crevices.
- After the paste has dried, it can be swept up and placed into the plastic container for disposal.

Medical Emergencies

Personal injury is not uncommon in laboratories. These injuries are usually minor cuts or burns but can be as severe as acute effects of chemical exposure or incidents such as heart attacks or strokes. Prevention of injuries should be a major emphasis of any laboratory safety program. Proper training will help prevent injuries from glassware, toxic chemicals burns and electrical shock. In the event of any personal injury, the initial responsibility for first aid rests with the first persons at the scene, who should react quickly but in a calm and reassuring manner. The person assuming responsibility should:
The following details should be posted at each laboratory:
The names of person(s) with telephone number in the area trained in CPR (cardio pulmonary resuscitation) and First Aid.

General First Aid

First Aid Box /equipment should be readily available in each laboratory.

Following any First Aid, a nurse or physician qualified to handle chemical emergencies should provide further examination and treatment. The location and phone number of

Emergency services should be clearly posted.

It is recommended that each Department have at least one person trained in basic First Aid and Cardio Pulmonary Resuscitation (CPR).

Someone having knowledgeable about the accident should always accompany the injured person to the medical facility and provide a copy of any appropriate MSDS if the accident resulted from chemical exposure.

Minor injuries requiring first aid should always be reported to a supervisor andrecorded reasons for this are as follows.

A minor injury may indicate a hazardous situation that should be corrected to prevent a serious future injury.

Personal Protection during First Aid

Persons responding to a medical emergency should be protected from exposure to bloodand other potentially infectious materials. Protection can be achieved through adherenceto work practices designed to minimize or eliminate exposure and through the use of personal protective equipment (i.e., gloves, masks, and protective clothing), which provide a barrier between the worker and the exposure source. For most situations in which first aid is given, the following guidelines should be adequate.

- For bleeding control with minimal bleeding and for handling and cleaning instruments with microbial contamination, disposable gloves alone should be sufficient.
- For bleeding control with excessive blood, disposable gloves, a coat, a mask, and protective eyewear are recommended.
- For measuring temperature or measuring blood pressure, no protection is required.

After emergency care has been administered, hands and other skin surfaces should be washed immediately and thoroughly with warm water and soap if contaminated with blood, other body fluids to which universal precautions apply, or potentially contaminated articles. Hands should always be washed after gloves are removed, even if the gloves appear to be intact.

10.8. LEAKING COMPRESSED GAS CYLINDERS

Occasionally, a cylinder or one of its component parts develops a leak. Most such leaksoccur at the top of the cylinder in areas such as the valve threads, safety device, valve stem, and valve outlet.

If a leak is suspected, do not use a flame for detection; rather, a flammable-gas leak detector orsoapy water or other suitable "**snoop**" solution should be used. If the leak cannot be remedied by tightening a valve gland or a packing nut, emergency action procedures should be affected. Laboratory workers should never attempt to repair a leak at the valve threads or safety device; rather, they should consult with the supplier for instructions

CHAPTER 11
EMERGENCY SITUATIONS

Emergency Numbers

Table 11.1 Emergency Numbers

Pazhayannur Police Station	04884 227 250
Ambulance	102
Accident / Emergency	108
P K Das Hospital	0466 234 4500
Govt. Hospital, Thiruvilwamala	04884 282 002
P K Das Medical College, Vaniyamkulam	0466 23 44700
Valluvanad Hospital Complex, Kanniyampuram, Ottapalam	0466 224 4423
Primary Health Centre, Lakkidi	0466 2231189
Police Station	100
Water Emergency	101
Electrical Emergency	1912
Women(Safe) Helpline	1091
Vanitha Help Line	1090
Kerala Fire and rescue services, Shoranur	0466 2222501
Women‘s Cell, Thrissur	0480-2364202
NCP Office	0466 2344800

All accidents, injuries, or near-misses should be reported to your Head of the Department/laboratory superintendent and then to the Safety Committee without any delay. If the incident occurred in the lab, superintendent is required to submit a Report of Accident, Injury, or Occupational illness and send it to the Head of the Department. Students and lab superintendent should understand that the purpose of reporting and documenting accidents is not to affix blame, but instead to determine the root cause of the accident so that re-occurrence of similar incidents may be prevented in the future.

Minor injuries many times are not reported because they are perceived to be embarrassing or that "**careless actions**" lead to the accident. However, minor injuries can sometimes lead to more serious complications that only become evident at a later time. Taking corrective action as a result of a minor accident may keep a major incident from happening. Without knowledge of all minor accidents, the desirable investigation and resulting corrective actions are circumvented.

CHAPTER 12
FIRE SAFETY

The Four Elements of Fire

- Fuel (such as wood, paper, cloth, propane, gasoline, kerosene)
- Oxygen (16% of the air)
- Heat (for instance, a match or spark)
- The chemical reaction that results from fuel, oxygen and heat mixing in the right quantity, at the right time

❖ Carbon dioxide

12.1 DIFFERENT TYPES OF FIRE ESTINGUISHERS

Class of Fire	Type of fire
A	Wood, Paper and clothing which produce glowing embers or char.
B	Flammable Gases, Liquids and Greases Including Gasoline And Most Hydrocarbon Liquids Which Must Be Vaporized For Combustion To Occur
C	Electrical Equipment Or In Materials Near Electrically Powered Equipment
D	Combustible metals, such as magnesium, zirconium, potassium, and sodium

❖ Water

❖ Dry chemical powder

❖ Mechanical Foam Type

❖ Specialized fire extinguishers for metal fires

CLASS	A	B	B	C	D	K
PICTURE SYMBOL						
TYPE	Common Combustibles Solids (wood, paper, cloth, etc.)	Flammable liquids Gasoline and solvents	Flammable gases Propane	Live electrical equipment Computers, fax machines	Combustible Metals Magnesium, Lithium, Titanium	Cooking Media Cooking oils and fats
Water	✓ Yes	✗ No	✗ No	✗ No	✗ No	✗ No
Foam	✓ Yes	✓ Yes	✗ No	✗ No	✗ No	✓ Yes (ABF Foam Only)
Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No	✗ No
M28/L2	✗ No	✗ No	✗ No	✗ No	✓ Yes	✗ No
Carbon Dioxide CO2	✗ No	✓ Yes	✗ No	✓ Yes	✗ No	✗ No
Wet Chemical	✓ Yes	✗ No	✗ No	✗ No	✗ No	✓ Yes

FIG.12.1 FIRE TYPE AND EXTINGUISHER CHART

12.1.1 Water (CO_2 cartridge) type fire extinguisher

FIG.12.2 WATER (CO_2 CATRIDGE) TYPE EXTINGUISHER

- ❖ Cools burning material. Very effective against fires in furniture, fabrics, etc. (including deep seated fires), and can be safely used only in the absence of electricity.

- ❖ Its inner container is filled with water & cap assemble is fixed with the CO_2 cartridge. It is used for class-A fires only.

- ❖ Air-pressurized water (APW) type extinguisher cools the burning material by absorbing heat from the same. Effective on class-A fires, it has the advantage ofbeing inexpensive, harmless, and relatively easy to clean up.

12.1.2 Mechanical Foam Extinguishers

FIG. 12.3 FORM TYPE EXTINGUISHER

Foam Extinguisher contains a foam solution and CO_2 cartridge connected to cap. The discharge hose fixed nozzle with aeration provision.

When foam extinguisher is used the foam should not be allowed to strike the surface of burning liquid, but should be directed against a side wall or any vertical surface of the container so that the foam runs down and forms a blanket which will spread over the liquid.

Where the liquid is not confined the foam should be allowed to fall gently on it such a way as to build up a blanket which will flow over the burning surface

12.1.3 Dry chemical powder (DCP) extinguisher

FIG.12.4 DRY CHEMICAL POWDER (DCP) TYPE EXTINGUISHER

Dry chemical extinguishers are intended for use on CLASS A, CLASS B, and CLASS C fires.

It is mainly filled with any of the following chemical powder and pressurizes with CO_2 cartridge or air:

1. Sodium bicarbonate ($NaHCO_3$)
2. Potassium bicarbonate ($KHCO_3$)
3. Urea based potassium bicarbonate
4. Mono Ammonium phosphate (NH_4) H_2PO_4

- The discharge should be directed at the base of the flames.
- Attack the near edge of the fire and progressing forward, moving the nozzle rapidly with a side-to-side sweeping motion for best results.
- Do not blast flaming liquid around the area.
- To prevent possible re-flash continue discharge after flames are extinguished.

12.1.4 CO_2 Fire Extinguisher

FIG.12.5 CARBON DIOXIDE (CO2)
TYPE EXTINGUISHER

Carbon Dioxide extinguishers are designed for Class B and C (flammable liquid and electrical) fires only.
They are filled with non-flammable carbon dioxide gas under extreme pressure. You
Can identify /recognize a CO_2 extinguisher by its hard horn and lack of pressure gauge. The pressure in the cylinder is so great that when you use one of these extinguishers, bits of dry ice may shoot out of the horn.

These extinguishers are intended primarily for use on CLASS B and CLASS C fires.

- Initial application must start reasonably close to the fire.
- On all fires the discharge should be directed at the base of the flames.
- CO_2 discharge should be applied to the burned surface even after the flames are extinguished, to prevent possible re-flash.

In case of flammable liquid fires, apply the discharge from the fire extinguisher first at the near edge of the fire and gradually progressing forward in order to get the best results. Carbon Dioxide is a non-flammable gas that extinguishes fire by displacing oxygen, or taking away the oxygen element of the fire triangle. The carbon dioxide is also very cold as it comes out of the extinguisher, so it cools the fuel as well. CO_2s may be ineffective at extinguishing Class A fires because they may not be able to displace enough oxygen to

Role of Discharge Horn

Its main duty to stop the entrainment of air with CO_2 and reduce the velocity of. CO_2 Without the horn, the jet of CO_2 acts like a blow torch and may by velocity increase the intensity of fire.

12.1.5 Wet chemical Fire extinguishers

FIG.12.7 WET CHEMICAL TYPE EXTINGUISHER

Also known as Class F'fire extinguishers, Class ABF' fire extinguishers – some versions only

Wet chemical fire extinguisher uses:

12.1.6.1 Fires involving cooking oils and fats, such as lard, olive oil, butter and vegetable oil

12.1.6.2 Fires involving flammable solids, such as paper, wood, and textiles (_**Class A** 'fires) some wet chemical fire extinguishers are also cleared for use on class B fires – those involving flammable liquids, such as petrol, diesel, and paint. Check the label or ask your fire safety professional before using wet chemical extinguishers on this type of fire.

Do not use wet chemical fire extinguishers for:

• Fires involving flammable liquids (_**Class B**' fires) UNLESS they are specifically cleared for this use

• Fires involving flammable gases, such as methane and butane (_class C' fires)

• Electrical fires

How to identify a wet chemical fire extinguisher:

• YELLOW colored label stating _Wet Chemical‘
• Has a longer than usual hose with a _lance‘ attachment
• Should be identified by an extinguisher ID sign fixed nearby – _Wet Chemical Extinguisher‘

The _chemical ‘element of wet chemical fire extinguishers is potassium.

Potassium salts are sprayed out as a fine mist (gently, so as not to spread the burning oil or fat), and these react to create a soapy film on the surface of the substance on fire.

This smothers the fire, with the added benefit that the mist also creates a cooling effect.

12.2 RULES OF FIGHTING FIRES

- Fires can be very dangerous and you should always be certain that you will not endanger yourself or others when attempting to put out a fire

- Assist any person in immediate danger to safety, if it can be accomplished without risk to you.

- Only after having done these things, if the fire is small, you may attempt to use an extinguisher to put it out.

However, before deciding to fight the fire, keep these rules in mind:

- Do Not Fight the Fire If you don't have adequate or appropriate equipment You might inhale toxic smoke

- The final rule is to always position yourself with an exit or means of escape at your back before you attempt to use an extinguisher to put out a fire.

12.3 LOCATION AND MARKING

Extinguishers should be properly located clearly visible and easily accessible for immediate use in the case of fire. Directional arrows will be provided to indicate the location of extinguishers, in locations where visual obstruction cannot be completely avoided. All extinguishers should be labelled indicating clearly the type of fire used for.

12.1.6 Distribution and Mounting of Extinguishers

Extinguishers must be distributed in such a way that the amount of time needed to travel to their location and back to the fire does not allow the fire to get out of control

Extinguishers will be installed on hangers, brackets, in cabinets, or on shelves.

Extinguishers having a gross weight not exceeding 40 pounds will be so installed that the top of the extinguisher is not more than 3-1/2 feet above the floor.

Extinguishers mounted in cabinets or wall recesses or set on shelves will be placed so that the extinguisher operating instructions face outward.

12.1.7 Maintaining Portable Fire Extinguishers

- Must maintain in a fully charged and operable condition.
- Must keep in their designated places at all times except during use.
- Must conduct an annual maintenance check.
- Must record the annual maintenance date and retain this record for one year after the last entry or the life of the shell, whichever is less.
- The extinguisher should be mounted on the wall.
- The area in front of the extinguisher shall be clear with no obstructions.
- The pressure gauge should be in the green zone.
- The inspection tag should show that the extinguisher has been inspected within the last year.

12.3 PROPER USE OF FIRE ESTINGUISHERS

- All extinguishers have simple instructions on them, and they are usually some variation of these simple steps:
- Pull the pin.
- Aim the extinguisher hose or nozzle at the base of the fire.
- Squeeze the handle.
- Sweep it slowly back and forth in order to cover the entire fire with the extinguishing substance.

12.4 FIRE ALARM

- ❖ In the event of a fire emergency, an emergency alarm will sound for the building.
- ❖ Upon hearing three consecutive alarms, all persons shall evacuate the building and

Assemble in the designated assembly point.

- ❖ All persons shall evacuate, unless a testing of the alarm system is announced.
- ❖ The person setting off the alarm should call the fire department and campus security (0466 2231550), and verify the emergency.
- ❖ Emergency alarms shall be tested once per month.

12.5 FIRE DRILLS

Fire drills should be performed at least once per year. All personnel and Users shall participate, with NO exceptions. All personal involved in the fire drill should be informed ahead of time. All personnel shall evacuate, as in a real fire, to the designated assembly area.

12.6 FIRE EMERGENCY PROCEDURES

The safety procedures discussed here are in line with the Indian Standard IS14435/1997

If you discover a fire:

- ❖ Activate the nearest fire alarm.
- ❖ Notify the fire department by dialing 101. Give your location, the nature of the

Fire, and your name.

- Notify Head of the Department and other occupants.

Fight the fire ONLY if:

- The fire department has been notified of the fire
- The fire is small and confined to its area of origin
- You have a way out and can fight the fire with your back to the exit
- You have the proper extinguisher, in good working order and know how to use it. If you are not sure of your ability or the fire extinguisher capacity to contain the fire, leave the area.

If you hear a fire alarm:

- Evacuate the area. Close windows, turn off gas jets, and close doors as you leave.
- Leave the building and move away from exits and out of the way of emergency operations.
- Assemble in a designated area.
- Report to the campus security so he can determine that all personnel have evacuated your area.
- Remain outside until competent authority states that it is safe to re-enter.
- Evacuation Routes
- Learn at least two escape routes, and emergency exits from your area.
- Learn to activate an emergency alarm.
- Learn to recognize alarm sounds.
- Take an active part in fire evacuation drills.

CHAPTER 13 CHEMICAL HAZARD

13.1 INTRODUCTION

The specific rules and procedures for working with hazardous chemicals, outlined in this chapter, give an insight into the proper methods for handling materials, which pose significant hazards due primarily to their chronic toxicity. However, these specific rules and procedures, along with the general rules for working with chemicals, do not address some of the basic physical hazards, which may stem from acute exposure to different types of laboratory chemicals. This chapter offers some specific guidelines for working with common laboratory chemicals that, for varying reasons, are acutely toxic in the sense that they may cause considerable harm to human life and health pending short term exposures. The Chapter addresses five fundamental classes of laboratory chemicals: flammables, corrosives, and oxidizers, reactive and compressed gases. These classes of chemicals may include chemicals that are also covered in the previous section regarding their property of toxicity.

The National Fire Protection Association (**NFPA**) has developed a color-coded numerical system for indicating the **health (blue)**, **flammability (red)** and **reactivity (yellow**) hazards of chemicals. The degree and type of hazard are summarized in Fig. 3.1. NFPA labels are required on all chemicals in the some purchased chemicals already have these markings (or their equivalents) on the container. Other ones don‘t have such markings and should have a NFPA label put on them **immediately**. Labeling is shown in fig 3.2. The degree of hazard associated with a particular substance ranges between 0 to 4 with 4 being extremely dangerous and 0 indicates no harm.

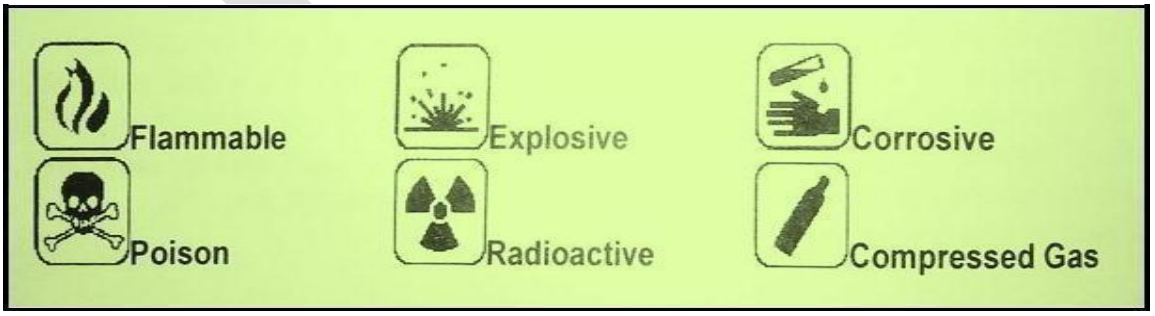

Fig.13.1. The degree and type of hazard

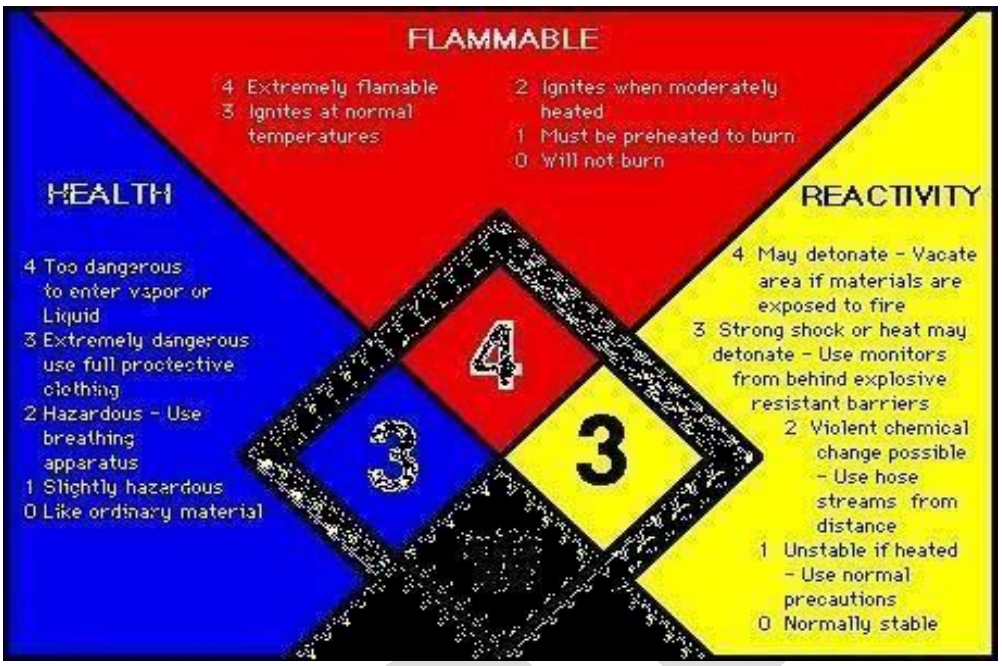

Fig.13.2. NPFA Health Hazard of chemicals

Health Hazard

0. Material offers no health hazard.

1. Material only slightly hazardous to health. Exposure could cause irritation if not treated.

2. Exposure could cause injury. Exposure requires prompt treatment. Appropriate protective equipment should be worn.

3. Exposure could cause serious injury. Appropriate protective equipment should be worn.

4. Could cause serious injury or death. Only special protective equipment designed specifically to protect against the specific hazard should be worn.

Flammability Hazard

0. Will not burn.

1. Ignites after considerable heating.

2. Ignites if moderately heated.

3. Can be ignited at all normal temperatures.

4. Highly flammable gases or highly volatile flammable liquids

Reactivity (Stability) Hazard

0. Normally stable. Not reactive with water.

1. Normally stable. Unstable at high temperature and pressure. Reacts with water.

2. Normally unstable but will not detonate. Materials can undergo chemical change with rapid release of energy.

3. Can detonate or explode, but requires strong initiating force or heating under containment.

4. Readily detonates or explodes.

13.2 FLAMABLE SOLVENTS

Flammable liquids are the most common chemicals found in a laboratory. The primary hazard associated with flammable liquids is, of course, their ability to readily ignite and burn. One should note that it is the vapor of a flammable liquid, not the liquid itself that ignites and causes a fire. Examples of flammable liquids are acetone, ethyl ether, toluene, methyl format, etc. In general, the vapors of many flammables are irritating to mucous membranes of the respiratory system and eyes, and in high concentrations are narcotic.

1. The rate at which a liquid vaporizes is a function of its *vapor pressure*. In general, liquids with high vapor pressures evaporate at a higher rate compared to liquids of lower vapor pressure. It should be noted that the vapor pressure increases rapidly as the temperature is raised, as does the evaporation rate. A reduced-pressure environment also accelerates the rate of evaporation.
2. The *flash point* of a liquid is the lowest temperature at which a liquid gives off vapor at such a rate as to form an air: vapor mixture that will ignite, but will not sustain ignition. Many commonly used flammable solvents have flashpoints significantly lower than room temperature. The table 3.1 shows the flash point of few commonly used solvents.

Compound	**Flash Point (°C)**
Diethyl ether	-45.0
Acetone	-17.8
Isopropyl alcohol	11.7

Table 12.1. Flash point of few commonly used solvents

3. The *limits of flammability* or *explosively* define the range of fuel air mixtures that will sustain combustion. The lower limit of this range is called the *Lower Explosive Limit* or LEL, and the higher limit of this range is called the *Upper Explosive Limit*

or UEL. Materials with very broad flammability ranges (e.g. acetylene, LEL = 3%, UEL = 65%) are particularly treacherous due to the fact that virtually any fuel air combination may form an explosive atmosphere.

4. The *vapor density* of a flammable material is the density (mass to volume ratio) of the corresponding vapor relative to air under specific temperature and pressure conditions. Flammable vapors with densities greater than unity (and thus "heavier" than air) are potentially lethal because they will accumulate at floor level and flow, with remarkable ease, in much the same manner that a liquid would. The obvious threat is that these mobile vapors may eventually reach an ignition source, such as an electrical outlet or a Bunsen burner at another student's bench.

13.2.1 Use and storage

1. Flammable liquids that are not in active use must be stored in safe containers inside fire resistant storage cabinets designed for flammables, or inside storage rooms.
2. Minimize the amount of flammable liquids stored in the lab.
3. Use flammables only in areas free of ignition sources.
4. The transfer of material to or from a metal container is generally accompanied by an accumulation of static charge on the container. This fact must be kept in mind when transferring flammable liquids, since the discharge of this static charge could generate a spark, thereby igniting the liquid. To make these transfers safer, flammable liquid dispensing and receiving containers must be bonded together before pouring. Large containers such as drums must also be grounded when used as dispensing or receiving vessels. All grounding and bonding connections neighbours must be metal to metal. (The aforementioned bonding and grounding wires may be found in most lab safety catalogs).
5. Never heat flammables with an open flame. Instead, use steam baths, water baths, oil baths, hot air baths, sand baths or heating mantles.
6. Do not store flammable liquids in a refrigerator unless it is approved for such storage. Such refrigerators are designed with non-sparking components to avoid an explosion.

13.2.2 First aid

The first aids to be given to a person in case of exposure to flame/ flammable solvents are presented in table below.

Inhalation Exposures	• Remove person from the contaminated area if it is safe to do so. • Get medical attention and do not leave person unattended
Ingestion Exposures	• Remove the person, if possible, from the source of contamination. • Get medical attention
Dermal Exposures	• Remove person from source of contamination. • Remove clothing, jewellery, and shoes from the affected areas. • Obtain medical attention.
Eye Contact	• Remove person from the source of contamination. • Flush the eyes with water for at least 15 minutes. • Obtain medical attention.

13.2.3 Personal protective equipment

Always use a fume hood while working with flammable liquids. Nitrile and neoprene gloves are effective against most flammables. Wear a non-flammable lab coat to provide a barrier to your skin and goggles if splashing is likely to occur.

13.3 OXIDIZERS

Oxidizers or oxidizing agents pose fire and explosion hazards on contact with combustible materials. Depending on the class, an oxidizing material may increase the burning rate of combustibles with which it comes in contact; It cause the spontaneous ignition of combustibles with which it comes in contact; or undergo an explosive reaction when exposed to heat, shock, or friction. Oxidizers are generally corrosive and many are highly toxic. Some examples of common oxidizers include peroxides, nitrites, nitrates, perchlorates, chlorates, chlorites, hypochlorite, dichromate, among others.

Use and storage

1. In general, store oxidizers away from flammables, organic compounds, and combustible materials.
2. Strong oxidizing agents like chromic acid should be stored in glass or some other inert container, preferably unbreakable. Corks and rubber stoppers should not be used.

3. Reaction vessels containing appreciable amounts of oxidizing material should never be heated in oil baths, but rather on a heating mantle or sand bath.

Use and storage of perchloric acid

Perchloric acid is an oxidizing agent of particular concern. The oxidizing power of perchloric acid increases with an increase in concentration and with an increase in temperature. Cold, 70% perchloric acid is a strong, non-oxidizing corrosive. A 72% perchloric acid solution at elevated temperatures is a strong oxidizing agent. An 85% perchloric acid solution is a strong oxidizer at room temperature.

1. Do not attempt to heat perchloric acid if you do not have access to a properly functioning perchloric acid fume hood. Perchloric acid can only be heated in a hood specially equipped with a washdown system to remove any perchloric acid residue. The hood should be washed down after each use and it is preferred to dedicate the hood to perchloric acid use only.
2. Whenever possible, substitute a less hazardous chemical for perchloric acid.
3. Perchloric acid can be stored in a perchloric acid fume hood. Keep only the minimum amount necessary for your work. Another acceptable storage site for perchloric acid is on a metal shelf or in a metal cabinet away from 45 organic or flammable materials. A bottle of perchloric acid should also be stored in a glass secondary container to contain leakage.
4. Do not allow perchloric acid to come in contact with any strong dehydrating agents such as sulphuric acid. The dehydration of perchloric acid is a severe fire and explosion hazard.
5. Do not order or use anhydrous perchloric acid. It is unstable at room temperature and can decompose spontaneously with a severe explosion. Anhydrous perchloric acid will explode upon contact with wood.

First aid

In general, if a person has inhaled, ingested, or come into direct contact with these materials, the person must be removed from the source of contamination as quickly as possible when it is safe to do so. Medical help must be obtained. In the case of an exposure directly to the skin or eyes it is imperative that the exposed person be taken to an emergency shower or eyewash immediately. Flush the affected area for a minimum of 15 minutes, and then get medical attention.

Personal Protective Equipment (PPE)

In many cases, the glove of choice will be neoprene, polyvinyl chloride (PVC), or nitrile. Be sure to consult a glove compatibility chart to ensure the glove material is appropriate forthe particular chemical you are working with. Goggles must be worn if the potential for splashing exists or if exposure to vapor or gas is likely. Always use these materials in a chemical fume hood as most pose a hazard via inhalation. Cylinders of compressed gases should be kept in ventilated cabinets.

13.4 CORROSIVES

13.4.1 General characteristics

1. Corrosives are most commonly acids and alkalis, but many other materials can be severely damaging to living tissue.
2. Corrosives can cause visible destruction or irreversible alterations at the site of contact. Inhalation of the vapor or mist can cause severe bronchial irritation, corrosives are particularly damaging to the skin and eyes.
3. Certain substances considered non-corrosive in their natural dry state are corrosive when wet such as when in contact with moist skin or mucus membranes. An example of these materials is lithium chloride, halogen fluorides, and allyl iodide.
4. Sulphuric acid is a very strong dehydrating agent and nitric acid is a strong oxidizing agent. Dehydrating agents can cause severe burns to the eyes due to their affinity for water.

Examples of corrosives include sulphuric acid, chromic acid, ammonium bifluoride, bromine, ammonium hydroxide, among others. All corrosives possess the property of being severely damaging to living tissues and also attack other materials such as metal. Skin contact with alkali metal hydroxides, e.g. sodium hydroxide and potassium hydroxide, is more dangerous than with strong acids. Contact with alkali metal hydroxides normally causes deeper tissue damage because there is less pain than with an acid exposure. The exposed person may not wash it off thoroughly enough or seek prompt medical attention. All hydrogen halides are acids that are serious respiratory irritants and also cause severe burns. Hydrofluoric acid is particularly dangerous. At low concentrations, hydrofluoric acid does not immediately show any signs or symptoms upon contact with skin. It may take several hours for the hydrofluoric acid to penetrate the skin before you would notice a

Burning sensation. However, by this time permanent damage, such as second and third degree burns with scarring, can result.

13.4.2 Use and storage

1. Always store acids separately from bases. Also, store acids in acid storage cabinets away from flammables since many acids are also strong oxidizers.
2. Do not work with corrosives unless an emergency shower and continuous flow eyewash are available.
3. Add acid to water, but never add water to acid. This is to prevent splashing from the acid due to the generation of excessive heat as the two substances mix.
    1. Never store corrosives above eye level. Store on a low shelf or cabinet.
    2. It is a good practice to store corrosives in a tray or bucket to contain any leakage.
4. When possible, purchase corrosives in containers that are coated with a protective plastic film that will minimize the danger to personnel if the container is dropped.
5. Store corrosives in a wooden cabinet or one that has a corrosion-resistant lining. Corrosives stored in an ordinary metal cabinet will quickly damage it. If the cabinet supports that hold up the shelves become corroded, the result could be serious. Acids should be stored in acid storage cabinets specially designed to hold them and Nitric acid should be stored in a separate cabinet or compartment.

i. Use and storage of hydrofluoric acid

1. Hydrofluoric acid is extremely hazardous and deserves special mention. Hydrofluoric acid can cause severe burns and inhalation of anhydrous hydrogen fluoride can be fatal. Initial skin contact with hydrofluoric acid may not produce any symptoms.
2. Only persons fully trained in the hazards of hydrofluoric acid should use it.
3. Always use hydrofluoric acid in a properly functioning fume hood. Be sure to wear personal protective clothing!
4. If you suspect that you have come in direct contact with hydrofluoric acid: wash the area with water for at least 15 minutes, remove clothing, then promptly seek medical attention. If hydrogen fluoride vapors are inhaled, move the person immediately to an uncontaminated atmosphere (if safe to do so), keep the person warm, and seek prompt medical attention.

5. Never store hydrofluoric acid in a glass container because it is incompatible with glass.
6. Store hydrofluoric acid separately in an acid storage cabinet and keep only that amount necessary in the lab. Creams for treatment of hydrofluoric acid exposure are commercially available.

ii. First Aid

The first aids to be provided to a person in case of exposure to hydrochloric acid are presented in table below.

Inhalation	❖ Remove person from source of contamination if safe to do so. ❖ Get medical attention. ❖ Keep person warm and quiet and do not leave unattended.
Ingestion	❖ Remove person from source of contamination. ❖ Get medical attention and inform emergency responders of the name of the chemical swallowed.
Skin Contact	❖ Remove person from source of contamination and take immediately to an emergency shower or source of water. ❖ Remove clothing, shoes, socks, and jewelry from affected Skin Contact areas as quickly as possible, cutting them off if necessary. ❖ Be careful not to get any chemical on your skin or to inhale the vapors. ❖ Flush the affected area with water for a minimum of 15 minutes. Get medical attention.
Eye Contact	❖ Remove person from source of contamination and take immediately to an eyewash or source of water. ❖ Rinse the eyes for a minimum of 15 minutes. Have the person look up and down and from side to side. ❖ Get medical attention. Do not let the person rub their eyes or keep them shut tightly.

iii. Personal protective equipment

Always wear the proper gloves when working with acids. Neoprene and nitrile gloves are effective against most acids and bases. Polyvinyl chloride (PVC) is also effective for most acids. A rubber coated apron and goggles should also be worn. If splashing is likely to occur, wear a face shield over the goggles. Always use corrosives in a chemical fume hood.

13.5 REACTIVES

13.5.1 General characteristics

Reactive chemicals are grouped as a category primarily because of the safety hazards associated with their use and storage and not because of similar acute or chronic health effects. For health hazard information on specific reactive materials consult the MSDS, or the manufacturer. However, there are some hazards common to the use of reactive materials. Injuries can occur due to heat or flames, inhalation of fumes, vapors, and reaction products, and flying debris.

Polymerization reactions:

Polymerization is a chemical reaction in which two or more molecules of a substance combine to form repeating structural units of the original molecule. This can result in an extremely high or uncontrolled release of eat. An example of a chemical which can undergo a polymerization reaction is styrene.

Water reactive materials:

1. When water reactive materials come in contact with water, one or more of the following can occur: liberation of heat which may cause ignition of the chemical itself if it is flammable, or ignition of flammables that are stored nearby; release of a flammable, toxic, or strong oxidizing gas; release of metal oxide fumes; and formation of corrosive acids.
2. Water reactive chemicals can be particularly hazardous to firefighting personnel responding to a fire in a lab, because water is the most commonly used fire extinguishing medium. Examples of water reactive materials include lithium, sodium, potassium, magnesium, zinc, alkyl-aluminums, among others.

Peroxide-forming materials:

Peroxides are very unstable and some chemicals that can form them are commonly used in laboratories. This makes peroxide-forming materials some of the most hazardous substances found in a lab. Peroxide-forming materials are chemicals that react with air, moisture, or impurities to form peroxides. The tendency to form peroxides by most of these materials is greatly increased by evaporation or distillation. Organic peroxides are extremely sensitive to shock, sparks, heat, friction, impact, and light. Many peroxides formed from materials

used in laboratories are more shock sensitive than TNT. Just the friction from unscrewing the cap of a container of ether that has peroxides in it can provide enough energy to cause a severe explosion. Examples of peroxide-forming materials (the first group listed is the most hazardous): diisopropyl ether divinylacetylene, sodium amide, potassium amide, dioxane diethyl ether,
tetrahydrofuran vinyl ethers, acrylonitrile styrene, among others.

Other shock-sensitive materials:

These materials are explosive and sensitive to heat and shock. Examples of shock sensitive materials: chemicals containing nitro groups, fulminates, hydrogen peroxide (30%+), ammonium perchlorate, benzoyl peroxide (when dry), compounds containing the functional groups: acetylide, azide, diazo, halamine, nitroso, and ozonide.

13.5.2 Use and storage

A good way to reduce the potential risks is to minimize the amount of material used in the experiment. Use only the amount of material necessary to achieve the desired results.

1. Always substitute a less hazardous chemical for a highly reactive chemical whenever possible. If it is necessary to use a highly reactive chemical, order only the amount that is necessary for the work.
2. Store water-reactive chemicals in an isolated part of the lab. A cabinet far removed from any water sources, such as sinks, emergency showers, and chillers, is an appropriate location. Clearly label the cabinet "**Water-Reactive Chemicals - No Water**".
3. Store pyrophoric in an isolated part of the lab and in a clearly marked cabinet. Be sure to routinely check the integrity of the container and have the material disposedof through EH&S if the container is corroded or otherwise damaged.
4. Do not open the chemical container if peroxide formation is suspected. The act of opening the container could be sufficient to cause a severe explosion. Visually inspect liquid peroxide forming materials for crystals or unusual viscosity before opening. Pay special attention to the area around the cap. Peroxides usually form upon evaporation, sothey will most likely be formed on the threads under the cap.
5. Date all peroxide forming materials with the date received, and the expected shelf life. Chemicals such as diisopropyl ether, divinyl acetylene, sodium amide and

vinylidene chloride should be discarded after three months. Chemicals such as dioxane, diethyl ether, and tetrahydrofuran should be submitted to EHSC for disposal after one year.

6. Store all peroxide-forming materials away from heat, sunlight, and sources of ignition. Sunlight accelerates the formation of peroxides.
7. Secure the lids and caps on containers of peroxide-forming materials to discourage the evaporation and concentration of these chemicals.
8. Never store peroxide-forming materials in glass containers with screw cap lids or glass stoppers. Friction and grinding must be avoided. Also, never store these chemicals in a clear glass bottle where they would be exposed to light.
9. If you notice crystal formation in the container or around the cap, do not attempt to open or move the container. Proper disposal should be carried out.
10. Never distill ether unless it is known to be free of peroxides.
11. Store other shock sensitive materials separately from other chemicals and in a clearly labeled cabinet.
12. Never allow picric acid to dry out, as it is extremely explosive. Always store picric acid in a wetted state.

13.5.3 First aid

1. If someone is seriously injured the most important step to take is to contact emergency responders as quickly as possible. This is best accomplished by directly calling them at 108. Explain the situation and describe the location clearly and accurately.
2. If someone is severely bleeding, apply a sterile dressing, clean cloth, or handkerchief to the wound. Then put protective gloves on and place the palm of your hand directly over the wound and apply pressure and keep the person calm. Continue to apply pressure until help arrives.
3. If a person's clothes are on fire, he or she should drop immediately to the floor and roll. If a fire blanket is available, put it over the individual. An emergency shower, if one is immediately available, can also be used to douse flames.
4. If a person goes into shock, have the individual lie down on their back if safe to do so and raise the feet about one foot above the floor.

13.5.4 Personal protective equipment

1. Wear appropriate personal protective clothing while working with highly reactive materials. This might include: impact resistant safety glasses or goggles, a face shield, gloves, a lab coat (to minimize injuries from flying glass or an explosive flash), and a shield.
2. Conduct work within a chemical fume hood as much as possible and pull down the sash as far as is practical. While the experiment does not require you to reach into the fume hood, keep the sash closed.
3. Barriers can offer protection of personnel against explosions and should be used. Many safety catalogs offer commercial shields which are commonly polycarbonate and are weighted at the bottom for stability. It may be necessary to secure the shields firmly to the work surface.

13.6 LABORATORIES

Laboratory safety

All students must read and understand the information in this document with regard to laboratory safety and emergency procedures prior to the first laboratory session. Students must adhere to written and verbal safety instructions throughout the academic term. Since additional instructions may be given at the beginning of laboratory sessions, it is important that all students arrive at each session on time

Personal and General laboratory safety

i. Never eat, drink, or smoke while working in the laboratory.
ii. Read labels carefully.
iii. Do not use any equipment unless you are trained and approved asa user by your supervisor.
iv. Wear safety glasses or face shields when working with hazardous materials and/or equipment.
v. Wear gloves when using any hazardous or toxic agent.
vi. Clothing: When handling dangerous substances, wear gloves, laboratory coats, and safety shield or glasses. Shorts and sandals should not be worn in the lab at any time.Shoes are required when working in the machine shops.
vii. If you have long hair or loose clothes, make sure it is tied back or confined

viii. Keep the work area clear of all materials except those needed for your work. Coats should be hung in the hall or placed in a locker. Extra books, purses, etc. should be kept away from equipment, which requires air flow or ventilation to prevent overheating.

ix. Disposal- Students are responsible for the proper disposal of used material if any inappropriate containers.

x. Equipment Failure- If a piece of equipment fails while being used, report it immediately to your lab assistant or tutor. Never try to fix the problem yourself because you could harm yourself and others.

xi. If leaving a lab unattended, turn off all ignition sources and lock the doors.

xii. Never pipette anything by mouth.

xiii. Clean up your work area before leaving.

xiv. Wash hands before leaving the lab and before eating.

Chemical safety

1. Treat every chemical as if it were hazardous.
2. Make sure all chemicals are clearly and currently labeled with the substance name, concentration, date, and name of the individual responsible.
3. Never return chemicals to reagent bottles. (Try for the correct amount and share any excess.)
4. Comply with fire regulations concerning storage quantities, types of approved containers and cabinets, proper labeling, etc. If uncertain about regulations, contact the building coordinator.
5. Use volatile and flammable compounds only in a fume hood. Procedures thatproduce aerosols should be performed in a hood to prevent inhalation of hazardous material.
6. Never allow a solvent to come in contact with your skin. Always use gloves.
7. Never "**smell" a solvent**!! Read the label on the solvent bottle to identify its contents.
8. Dispose of waste and broken glassware in proper containers.
9. Clean up spills immediately.
10. Do not store food in laboratories.

13.6.1 Chemical Exposures

The following procedures should be followed in the event of a chemical exposure. In all cases the incident should be reported to your laboratory chief, technician or principal investigator, regardless of severity.

Chemicals on skin or clothing

1. Immediately flush with water for no less than 15 minutes (except for hydrofluoric acid).
2. While rinsing, quickly remove all contaminated clothing or jewelry.
3. Use caution when removing pullover shirts or sweaters to prevent contamination of the eyes.
4. Check the MSDS (Material Safety Data Sheet) to determine if any delayed effects should be expected.
5. Discard contaminated clothing or launder them separately from other clothing. Leather garments or accessories cannot be decontaminated and should be discarded.

Do not use solvents to wash skin. They remove the natural protective oils from the skin and can cause irritation and inflammation. In some cases, washing with a solvent may facilitate absorption of a toxic chemical.

For flammable solids on skin, first brush off as much of the solid as possible, then proceed as described above.

For hydrofluoric acid, rinse with water for 5 minutes and apply calcium gluconate gel, then get immediate medical attention. If no gel is available, rinse for 15 minutes and consult a doctor immediately.

Chemicals in eyes

1. Immediately flush eye(s) with water for at least fifteen minutes. The eyes must be forcibly held open to wash, and the eyeballs must be rotated so all surface area is rinsed.
2. Remove contact lenses while rinsing. **Do not lose time removing contact lenses before rinsing**. Do not attempt to reinsert contact lenses.

3. Seek medical attention regardless of the severity or apparent lack of severity. Contact for an ambulance or transportation to a health center if it is needed. Explain carefully what chemicals were involved.

Chemical Inhalation

1. Close containers, open windows or otherwise increase ventilation, and circulate fresh air.
2. If symptoms, such as headaches, nose or throat irritation, dizziness, or drowsiness persist, seek medical attention by calling emergency or going to a health center. Explain carefully what chemicals were involved.
3. Review the MSDS to determine what health effects are expected, including delayed effects.

Accidental ingestion of chemicals

1. Immediately go to a health center or contact Ambulance at 108 for instructions.
2. Do not induce vomiting unless directed to do so by a health care provider.

Accidental injection of chemicals

Wash the area with soap and water and seek medical attention, if necessary immediately go to a health center or contact Ambulance at 108. Explain carefully what chemicals were involved.

13.6.2 Chemical Spills

All chemical spills, regardless of size, shall be reported in writing to your supervisor. The report shall include the date, time, location, chemical(s) and their volume, and names of all persons involved, including any visitors who were exposed and personnel involved in the cleanup.

Emergency spills

Chemical spill is classified as an Emergency Spill whenever it:

- ❖ Causes personal injury or chemical exposure that requires medical attention
- ❖ Causes a fire hazard or uncontrollable volatility

- Requires a need for breathing apparatus of the supplied air or self-contained type to handle the material involved
- Involves or contaminates a public area
- Causes airborne contamination that requires local or building evacuation
- Causes a spill that cannot be controlled or isolated by laboratory personnel
- Causes damage to college property that will require repairs
- Involves any quantity of metallic mercury
- Cannot be properly handled due to lack of local trained personnel and/or equipment to perform a safe, effective cleanup
- Requires prolonged or overnight cleanup
- Involves an unknown substance.

Minor spills

Minor spills are those spills that do not fit the requirements for Emergency Spills. The following general procedures should be used for all minor spills:

1. Attend to any persons who may have been contaminated. If these persons requiremedical attention this is an Emergency Spill (see above).
2. Notify persons in the immediate area about the spill.
3. Evacuate all nonessential personnel from the spill area.
4. If the spilled material is flammable, turn off ignition and heat sources.
5. Avoid breathing vapors of the spilled material. If respiratory protection is necessarythis is an Emergency Spill (see above).
6. Leave on or establish exhaust ventilation if it is safe to do so.
7. Secure supplies to effect cleanup.
8. Put on appropriate personnel protective equipment.
9. Spilled Liquids:

- Confine or contain the spill to a small area. Do not let it spread.
- For small quantities of inorganic acids or bases, use a neutralizing agent or an absorbent mixture (e.g., soda ash or liatomaceous earth). For small quantities of other materials absorb the spill with a noncreative material (such as vermiculite, clay, dry sand, or towels).

- For larger amounts of inorganic acids and bases, flush with large amounts of water (providing the water will not cause additional damage). Flooding is not recommended in store rooms where violent spattering may cause additional hazards or in areas where water reactive chemicals may be present.
- Carefully pick up and clean any cartons or bottles that have been splashed or immersed.
- If the spilled material is extremely volatile, let it evaporate and be exhausted by the laboratory hood (provided that the hood is authorized for use with the spilled chemical).

Spilled Solid

- Generally, sweep spilled solids into a dustpan and places them into a container suitable for that chemical.
- Dispose of residues according to safe disposal procedures. Remembering that personal protective equipment, brooms, dustpans, and other items may requirespecial disposal procedures.
- Report the chemical spill in writing as required above.

13.7 MERCURY HANDLING AND SPILL CLEAN UP

1. Storage and handling

- Always store mercury in unbreakable containers and stored in a well-ventilated area.
- When breakage of instruments or apparatus containing mercury is a possibility, theequipment should be placed in an enameled or plastic tray or pan that can be cleanedeasily and is large enough to contain the mercury.
- Transfers of mercury from one container to another should be carried out in a hood,over a tray or pan to confine any spills.
- If at all possible, the use of mercury thermometers should be avoided. If a mercury thermometer is required, many are now available with a Teflon coating that will prevent shattering.
- Always wash hands after handling mercury.

2. Protective Clothing

For small spills, a laboratory coat, safety glasses, and gloves should be used. Gloves madeof the following have been rated as excellent for protection against elemental mercury:

- Chlorinated polyethylene (CPE)
- Polyvinyl Chloride (PVC)

- Polyurethane
- Nitrile Rubber (also known by several brand names)
- Butyl Rubber
- Neoprene

If mercury has been spilled on the floor, the workers involved in cleanup and decontamination should wear plastic shoe covers.

3. Spill Kits

Special spill kits are available from a variety of sources. If a spill kit is purchased, follow the manufacturer's directions. Alternatively, a kit can be assembled with the following components:

- Protective gloves
- Mercury suction pump or disposable pipettes to recover small droplets
- Elemental zinc powder
- Dilute sulphuric acid (5-10%) in spray bottle
- Sponge
- Plastic trash bag
- Plastic container
- Plastic sealed vial for recovered mercury

4. Clean Up Procedures

- Wearing protective clothing, pools and droplets of metallic mercury can be pushed together and then collected by a suction pump.
- After the gross contamination has been removed, sprinkler the entire area with zinc powder. Spray the zinc with the dilute sulphuric acid.
- Using the sponge, work the zinc powder/sulphuric acid into a paste consistency while scrubbing the contaminated surface and cracks or crevices.
- After the paste has dried, it can be swept up and placed into the plastic container for disposal.
- Rags, shoe covers, sponges, and anything used for the cleanup should be placed in the trash bag to be disposed of as contaminated material.

CHAPTER 14
ELECTRICAL SAFETY

In many laboratories, electrically powered equipment can pose a significant hazard to laboratory workers, particularly when mishandled or not well maintained. Many laboratory electrical devices have high voltage or high power requirements, carrying even more risk. Electrical shock and fire are the major hazards associated with electricity.

14.1 ELECTRICAL HAZARDS

The severity and effects of an electrical shock depend on a number of factors, such as:

- The pathway through the body
- The amount of current
- The length of time of the exposure
- Whether the skin is wet or dry.

The table shows the general relationship between the degree of injury and amount of current for a 50-60 cycle hand-to-foot path of one second's duration of shock. While reading this chart, keep in mind that most electrical circuits can provide, under normal conditions, up to 20,000 milliamperes of current flow. Keeping in mind that the electrical shock hazards and sparks from electrical equipment can serve as an ignition source for flammable or explosive vapors orcombustible materials.

Current	**Reaction**
1 Milliampere	Perception level
5 Milliamperes	Slight shock felt; not painful but disturbing
6-30 Milliamperes	Painful shock; "let-go" range
50-150 Milliamperes	Extreme pain, respiratory arrest, severe muscular contraction
1000-4,300 Milli amperes	Ventricular fibrillation
10,000+ Milliamperes	Cardiac arrest, severe burns and probable death

Table 14.1 General relationship between the degree of injury and amount of current

Power loss

The following hazardous situations can be created due to the Loss of electrical power:

- If magnetic or mechanical stirrers fail to operate, safe mixing of reagents may be compromised.
- Fume hoods may cease to operate, allowing vapors to be released into the laboratory
- Flammable or toxic vapors may be released as a chemical warms when a refrigerator or freezer fails.

Fig 14.1 Two prong plug

Preventing Electrical Hazards

There are various ways of protecting people from the hazards caused by electricity, guarding insulation, guarding, grounding, and electrical protective devices.

1 Insulation

All electrical cords should have sufficient insulation to prevent direct contact with wires. In a laboratory, it is particularly important to check all cords before each use, since corrosive chemicals or solvents may erode the insulation. Damaged cords should be repaired or taken out of service immediately.

2 Guarding

Live parts of electric equipment operating at 50 volts or more must be guarded against accidental contact. Proper shields may be used to protect against exposed live parts.

3 Grounding

Only equipment with three-prong plugs (Fig 7.2) should be used in the laboratory instead of a two prong plug (Fig 7.1). The third prong provides a path to ground for internal electrical short circuits, thereby protecting the user from a potential electrical shock.

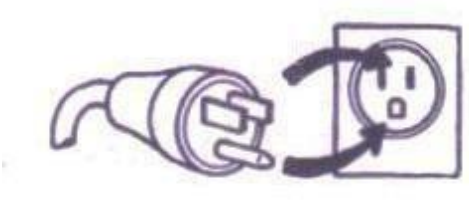

Fig 14.2 Three prong plug

4 Circuit protection devices

- Circuit protection devices, such as fuses, circuit breakers, ground-fault circuit interrupter, are designed to automatically shut off the flow of electricity in the event of a ground-fault, overload or short circuit in the wiring system.
- Fuses and circuit breakers like the one shown in figure prevent over-heating of wires and components that might otherwise create fire hazards. They disconnect the circuit when it becomes overloaded. This overload protection is very useful for equipment that is left on for extended periods of time, such as stirrers, vacuum pumps, drying ovens, and other electrical equipment.
- The ground-fault circuit interrupter, or GFCI, is designed to shutoff electric power if a ground fault is detected, protecting the user from a potential electrical shock. The GFCI is particularly useful near sinks and wet location.

Fig 14.3 MCB

Motors

All newly purchased equipment should have spark free induction motors. Any switches located on the device should be removed and insert a switch on the cord near the plug end. Laboratory workers can significantly reduce electrical hazards by following some basic precautions:

- Inspect wiring of equipment before each use. Replace damaged or frayed electrical cords immediately.
- Use safe work practices every time electrical equipment is used.
- Know the location and how to operate shut-off switches and/or circuit breaker panels. Use these devices to shut off equipment in the event of a fire or electrocution.
- Limit the use of extension cords. Use only for temporary operations and then only for short periods of time. In all other cases, request installation of a new electrical outlet.
- Multi-plug adapters must have circuit breakers or fuses.
- Place exposed electrical conductors (such as those sometimes used with electrophoresis devices) behind shields.
- Minimize the potential for water or chemical spills on or near electrical equipment.

14.2 SAFE WORK PRACTICES

The following are a list of rules for working with electrical equipment:

- Turn off the power to equipment before inspecting it.
- Check circuits for proper grounding with respect to the power source.
- Never change wiring with circuit plugged into power source.
- Never plug leads into power source unless they are connected to an established circuit.
- Keep access to electrical panels and disconnect switches clear and unobstructed.
- Tools and equipment with non-conducting handles should be used when working withElectrical devices.
- All current transmitting parts of any electrical devices must be enclosed.
- When checking an operating circuit, keep one hand either in a pocket or behind yourback to avoid making a closed circuit through the body.
- Avoid contacting circuits with wet hands or wet materials.
- Wet cells should be placed on a piece of non-conducting material.
- Do not insert another fuse of larger capacity if an instrument keeps blowing fuses -this is asymptom requiring expert repairs.
- Extension cords must be connected to a power strip equipped with a fuse.
- Do not use or store highly flammable solvents near electrical equipment.

- Multi-strip outlets (cube taps) should not be used in place of permanently installedreceptacles. If additional outlets are required have them installed by an electrician.

Static Electricity and Spark Hazards

Proper grounding of equipment and containers is necessary to avoid sparks. Sparks mayresult in explosions in areas where flammable liquids are being used. Some common potential sources of sparks are:

- The making and braking of an electrical circuit when the circuit is energized.
- Metal tanks and containers.
- Plastic lab aprons.
- Metal clamps, nipples, or wire used with no conducting hoses.
- High-pressure gas cylinders upon discharge.

CHAPTER 16
WASTE DISPOSAL SAFETY

The purpose of environmentally sound disposal methods is to prevent harm to the water, land, and air.

16.1 DEFINITIONS OF WASTE

Any useless and valueless material that is to be discarded.

Solid waste
Any garbage, refuse, sludge from a waste treatment plant, water treatment plant, or air pollution control facility or other discarded material. Solid waste can be solid, liquid, semi-solid, or contained gaseous material resulting from industrial, municipal, commercial,mining and agricultural operations, and from community and institutional activities.

Hazardous waste
Waste that poses substantial or potential threats to public health or the environment. It is any solid waste material exhibiting the characteristics of ignitability, corrosivity, reactivity or toxicity.

Mixed waste
Mixed-waste contains both radioactive and (chemically) hazardous waste

Disposal
The discharge, deposit, injection, dumping, spilling, or placing of any solid waste or hazardous waste (whether containerized or non-containerized) into or on any land or water so that such solid waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any water, including ground waters.

Types of Hazardous Waste
An item is considered waste when the owner determines that the material is no longer useful and needs to be discarded. An item is considered to be hazardous waste if it meets one or more of the following characteristics: A chemical component is listed as hazardous by Material Safety Data Sheet (MSDS); for example, see the website, www.msds.com .Mixture contains a listed hazardous waste and a non-hazardous waste. Material meets the definition of one of the following:

Ignitability (flashpoint <60°C or supports combustion)
Reactivity (e.g., water reactive, cyanides, explosives, unstable chemicals)
Corrosivity (ph<4 or >10)
Environmental Protection (EP) toxicity (e.g., pesticides, heavy metal.)

16.2 CONTAINERS AND TAGS

Proper containment, tagging, collection and disposal are essential to the success of the Hazardous Waste Program. The following sections discuss these areas.

Containers

Hazardous waste collection containers must be in good condition, must not leak, and must be compatible with their hazardous contents (e.g., do not use metal containers for corrosive waste or plastic containers for organic solvents). All containers must have suitable screw caps or other secure means of closure.

If you are reusing a container to accumulate waste, destroy the original product label. EPA regulations require that waste containers be labeled with the accumulation start date, the identity of the contents, and the words "**Hazardous Waste**". Use a new label to identify the hazardous waste: do not use the disposal tag for this purpose.

16.1.1 Hazardous waste containers for liquids are generally rated by volume capacity.

16.1.2 Allow extra room in liquid containers to allow for contents expansion.

16.1.3 Do not fill jugs and bottles past the shoulder of the container.

16.1.4 Fill closed head cans (5 gallons or less) to leave approximately two inches of space between the liquid level and the top of the container.

16.1.5 Fill closed head drums (Larger than 5 gallons) to leave approximately four inches of space.

16.1.6 Generally hazardous waste containers for solids are rated by their weight capacity and volume capacity. Take care not to exceed the weight capacity of a solid container. Weight is generally not a problem for jars and open head cans (5 gallons or less), but it can be a problem for open head drums (larger than 5 gallons). Depending on weight requirement, you may fill containers for solids within two inches of the closure.

16.1.7 Important: Keep all waste collection containers closed except when adding or removing material.

Disposing of Empty Containers

16.1.8 The disposing of empty containers must meet the following requirements:

16.1.9 Product labels must be defaced or removed.

16.1.10 Container lids or caps must be removed.

16.1.11 Containers must not contain free liquid or solid residue.

16.1.12 Containers must be triple rinsed.

16.1.13 It is not necessary to break empty glass containers.

16.1.14 Punch holes in the bottom of metal containers and plastic jugs before disposing of them in the regular trash.

Important: Containers that do meet the requirements mentioned here must be treated as hazardous waste.

16.3 WASTE MINIMIZATION TECHNIQUES

Lab Superintendents should follow these techniques to reduce hazardous waste:

16.1.15 Review waste streams and recommend waste minimization procedures.

16.1.16 Do not mix different types of waste.

16.1.17 Do not put non-hazardous waste, such as a mixture of water, sodium bicarbonate,and acetic acid, into a waste container of hazardous waste.

16.1.18 Do not combine inorganic heavy metal waste with organic solvents waste.

16.1.19 Segregate halogenated waste solvents from non-halogenated waste solvents. accidental contamination. Store waste containers separate from reagent containers being used to avoid accidental contamination. Decontaminate empty containers to make them non-hazardous.

16.1.20 Neutralize or dilute acids and bases to make them non-hazardous and suitable for drain

16.1.21 When possible, redesign experimental protocols so that harmful by products are detoxified or reduced.

16.1.22 Recycle chemicals via purification.

Waste Segregation

Many hazardous wastes, when mixed with other waste or materials, can produce effects which are harmful to human health and the environment, such Heat or pressure, Fire or explosion, Violent reaction, Toxic dusts, mists, fumes, or gases, or Flammable fumes or gases. Segregated waste is safer and easier to dispose of than non-segregated waste. Mixed waste as indicated above can result in severe consequences. Each lab superintendents who generates waste is personally responsible for the following Ensuring that hazardous wastes are accumulated in safe, transportable containers. Ensuring that hazardous wastes are stored properly to prevent possible exposure.

Incompatible Waste

Given below are the examples of potentially incompatible wastes, waste components, and materials, along with the harmful consequences, which result from mixing materials in one group with materials in another group. This list is not intended to be exhaustive. A waste generator must, as the regulations require, adequately control his wastes so that he can avoid creating uncontrolled substances or reactions of the type listed below, whether they are listed below or not. It is possible for potentially incompatible wastes to be mixed in a way that precludes a reaction (e.g., adding acid to water rather than water to acid) or that neutralizes them (e.g., a strong acid mixed with a strong base), or that controls substances produced (e.g., by generating flammable gases in a closed tank equipped so that ignition cannot occur,and burning the gases in an incinerator).

ANNEXURES

ANNEXURES I

SAFETY PROCEDURES IN PRACTICAL CLASSES IN COMPUTING LABS

The following procedures are designed to address the safety aspects that arise in classes where the students and staff open up the computer system units, add peripherals to the computers, or use cables to connect computers together. Because of the danger of electric shocks, it is particularly important to follow the safety procedures laid down.

1. Preliminary Precautions

In order that free access can be made to the front and back of computers, before starting practical work students should place all belongings, other than laboratory notes and tools supplied by the Lecturer/Demonstrator, on the benches at the side of the room. All chairs not in use should be pushed fully in to the bench.

2. Prior to Opening System Units

In general, if the class involves all the computer system units being opened up at the same time, then the electrical power supplied to the computers must be shut off and only switched on again when the Lecturer/Demonstrator is satisfied that it is safe to do so. The Lecturer/Demonstrator uses a special key, which switches off the power to all benches in the room. The Lecturer/Demonstrator must keep the key at all times to ensure that the power cannot be reapplied by anyone else. The students can then be instructed to:-

1. shut down the software on the computers correctly;
2. switch off the computer system unit and monitor;
3. switch off the plugs on the bench;
4. Remove the power connection from the computer system unit and the monitor.

The power in the laboratory can be switched off by the Lecturer/Demonstrator at this point and the system units can now be opened safely.

3. During the Class

During the class the students may add interface cards and peripherals or add/remove system board components like memory, processor, etc. The Lecturer/Demonstrator must ensure that the students replace/add components correctly before closing the system units. Once all covers are back on the computers the power can then be reapplied safely to the computer laboratory.

If the students need to add cables or peripherals to the computers they must ensure that all wires and leads are placed in such a manner that they will not present a tripping hazard.

4. Exceptional Circumstances

In certain situations the above procedures will prove over-restrictive for the successful progress of a practical class. For instance, some students may work much faster than others, or students may be required to work on different activities, which take different lengths of time. In these circumstances students may be unreasonably held up in their workif they have to wait for the whole class to be ready for the power to be switched on.

In these cases, where there is an adequate staff-student ratio, there are two options that can be considered:-

- Use the above safety precautions on a bench by bench basis, rather than the whole laboratory at a time.
- Use the above safety precautions, but instead of switching off power in the laboratory, the Lecturer/Demonstrator removes the fuse from each PC to avoid power being inadvertently supplied to a computer. The fuse can be replaced by theLecturer/Demonstrator, if safe to do so, to allow students to turn on the computer.
- Where it is not physically possible to remove the computer‘s fuse, all power cables may be removed

ANNEXURES II
LIST OF LABS

List of labs available in Nehru College of Pharmacy:

1. Pharmaceutical Chemistry - I
2. Pharmaceutical Chemistry - II
3. Pharmaceutical Chemistry - III
4. Pharmaceutical Chemistry - IV
5. Pharmaceutics - I
6. Pharmaceutics - II
7. Pharmaceutics - III
8. Pharmaceutical Biotechnology & Microbiology
9. Pharmacognosy - I
10. Pharmacology - I (HAP)
11. Pharmacology - II
12. Pharmacology lab - III
13. Central Instrumentation Lab
14. Pharmaceutics lab (M. Pharm)
15. Pharmacognosy Lab (M. Pharm)
16. Pharmacology lab (M. Pharm)
17. Regulatory Affairs lab (M. Pharm)
18. Machine Room
19. Institutional Incubation Cell (IIC) / Research Lab
20. Store Room - I
21. Store Room - II

ANNEXURES II
CHEMICAL SAFETY

1. The vapours of many organic solvents are flammable or combustible. Do not expose electric sparks, open flames and heating elements to organic solvent vapours. **UNLESS OTHERWISE STATED, ASSUME ALL ORGANIC SOLVENTS ARE FLAMMABLE.**
2. Many chemicals (solid, liquid or vapour) are poisonous. Do not taste chemicals. If it is necessary to smell a chemical, do so by fanning the vapours towards your nose. Never inhale directly. Avoid inhaling dust or fine powders. Use fume hoods and personal protective equipment when necessary.
3. Do not pipet with your mouth. Pipette
4. Be extremely careful when transferring, distilling or refluxing volatile liquids.
5. Do not return used chemicals back to the stock container.
6. Do not tap flasks under vacuum.
7. Do not heat, measure or mix any chemicals in front of your face.
8. Never heat a closed system - it will act as a bomb!
9. Dispose the used chemicals in a separate waste bin

BE AWARE ON THE HAZARDS

Symbol	Class Description	Symbol means that the material
	Compressed Gas (Class A)	• poses an explosion danger because the gas is being held in a cylinder under pressure • may cause its container to explode if heated • may cause its container to explode if dropped
	Combustible and Flammable Material (Class B)	• is one that will burn and is consequently a fire hazard (l.e., is combustible) • may catch fire at relatively low temperatures (i.e., is flammable) • may ignite spontaneously in air or release a flammable gas on contact with water
	Oxidizing Material (Class C)	• may react violently or cause an explosion when it comes into contact with combustible materials • may burn skin and eyes upon contact
	Poisonous Material: Immediate Toxic Effects (Class D1)	• is a potentially fatal poisoning substance • may be immediately fatal or cause permanent damage if it is inhaled or swallowed or enters the body through skin contact

	Poisonous Material: Other Toxic Effects (Class D2)	• is a poisonous substance that is not immediately hazardous to health • may cause death or permanent damage as a result of repeated exposure over time (e.g., cancer, birth defects or sterility) • may be an irritant
	Biohazardous Infectious Material (Class D3)	• may cause a serious disease resulting in illness or death • may produce a toxin that is harmful to humans
	Corrosive Material (Class E)	• causes severe eye and skin irritation upon contact • causes severe tissue damage with prolonged contact • may be harmful if inhaled
	Dangerously Reactive Material (Class F)	• is very unstable • may react with water to release a toxic or flammable gas • may explode as a result of shock, friction, or increase in temperature • may explode if heated in a closed container

ANNEXURES III
MICROBIOLOGY LAB PRACTICES AND SAFETY RULES

General

- ✓ Wash your hands with disinfectant soap when you arrive at the lab and again before you leave.
- ✓ Absolutely no food, drinks, chewing gum, or smoking is allowed in the laboratory.
- ✓ Do not put anything in your mouth such as pencils, pens, labels, or fingers.
- ✓ Do not store food in areas where microorganisms are stored.
- ✓ Purchase a lab coat and safety glasses, bring them to class, and use them.
- ✓ Alternatively, a long sleeved shirt that buttons or snaps closed is acceptable protective clothing.
- ✓ This garment must cover your arms and be able to be removed without pulling it
- ✓ Over your head.
- ✓ Leave protective clothing in the lab and do not wear it to other non- lab areas.
- ✓ Avoid loose fitting items of clothing.
- ✓ Wear appropriate shoes (sandals are not allowed) in the laboratory.
- ✓ Keep your workspace free of all unnecessary materials. Backpacks, purses, and coats should be placed in the cubbyholes by the front door of the lab.
- ✓ Place needed items on the floor near your feet, but not in the aisle.
- ✓ Disinfect work areas before and after use with 70% ethanol or fresh 10% bleach.
- ✓ Laboratory equipment and work surfaces should be decontaminated with an appropriate disinfectant on a routine basis, and especially after spills, splashes, or other contamination.
- ✓ Label everything clearly Replace caps on reagents, solution bottles, and bacterial cultures.

- ✓ Do not open Petri dishes in the lab unless absolutely necessary Inoculating loops and needles should be flame sterilized in a Bunsen burner before you lay them down.
- ✓ Turn off Bunsen burners when not is use Long hair must be restrained if Bunsen burners are in use.
- ✓ When you flame sterilize with alcohol, be sure that you do not have any papers under you.
- ✓ Treat all microorganisms as potential pathogens. Use appropriate care and do not take cultures out of the laboratory.
- ✓ Wear disposable gloves when working with potentially infectious microbes or samples (e.g.. sewage). If you are working with a sample that may contain a pathogen, then be extremely careful to use good bacteriological technique.
- ✓ Sterilize equipment and materials.
- ✓ Never pipette by mouth. Use a pipetting aid or adjustable volume pipettes. [la the distant past, some lab personnel were taught to mouth pipette. This practice has been known to result in many laboratory-acquired infections. With the availability of mechanical pipetting devices, mouth pipetting is strictly prohibited Consider everything a biohazard.
- ✓ Do not pour anything down the sink.
- ✓ Autoclave liquids and broth cultures to sterilize them before discarding.
- ✓ Dispose of all solid waste material in a biohazard bag and autoclave it before discarding in the regular trash.
- ✓ Familiarize yourself with the location of safety equipment in the lab (eg, eye- wash station, shower, sinks, lire extinguisher, biological safety cabinet, first aid kit, emergency gas valve).
- ✓ Dispose of broken glass in the broken glass container.
- ✓ Dispose of razor blades, syringe needles, and sharp metal objects in the "sharps" container.
- ✓ Report spills and accidents immediately to your instructor.
- ✓ Clean small spills with care (see instructions below). Seek help for large spills.
- ✓ Export all injuries or accidents immediately to the instructor, no matter how small they seem.

Laboratory Safety Equipment

Biological Safety Cabinet: A biological safety cabinet (ISC) is used as a primary barrier against exposure to infectious biological agents. A RSC has High Efficiency Particulate Air (HEPA) filters. The airflow in a BSC is laminar, The air moves with uniform velocity in one direction along parallel low lines. Depending on the design, a BSC may be vented to the outside or the air may be exhausted into the room. BSCs are not chemical fume boards. A percentage of the air is recirculated in most types of BSCs. HEPA Filters only trap particulates, allowing any contaminant in non-particulate form to pass through the filter.

Proper Use of BSCs:

- ✓ Operate the cabinet for five minutes before and after performing any work in it in order to purge airborne contaminants
- ✓ Before and after use, wipe the surface of the BSC with a suitable disinfectant, eg. 70% alcohol or a 10% bleach solution.
- ✓ Place everything you will need inside the cabinet before beginning work, including a waste
- ✓ Container. You should not have to penetrate the air harrier of the cabinet once work has begun.
- ✓ Do not place anything on the air intake grills, as this will block the air supply. You should prevent unnecessary opening and closing of door because this will disrupt the airflow of the cabinet
- ✓ Always wear a lab coat while using the cabinet and conduct your work at least lour inches inside the cabinet.
- ✓ Place burners to the rear of the cabinet to reduce air turbulence.
- ✓ Do not work in the BSC while the ultraviolet light is on. Ultraviolet light can quickly injure the eye.
- ✓ When finished with your work procedure, decontaminate the surfaces of any equipment.
- ✓ Remove the equipment from the cabinet and decontaminate the work surface. Thoroughly wash your hands and arms.

Cleaning Small Spills

- ✓ First, contact your instructor. If it is a small spill of a low hazard microorganism or sample, then you should clean the spill yourself.

- ✓ The proper procedures for cleaning small spills of microorganisms or samples (BSLI and BSL2 levels):
- ✓ Wear a lab coat, disposable gloves, safety glasses or a face shield, and if needed, approved respiratory equipment.
- ✓ Seek a paper towel(s) in an appropriate disinfectant (70% ethanol or fresh 10% bleach solution) and place around the spill area.
- ✓ Working from the outer edges into the centre, clean the spill area with fresh towels soaked in the disinfectant
- ✓ Be sure to decontaminate any areas or surfaces that you suspect may have been affected by the spill.
- ✓ Allow 10 minutes' contact time.
- ✓ Place the paper towels and gloves into a biohazard bag and autoclave these materials to sterilise them.
- ✓ Dispose of any contaminated clothing properly.
- ✓ Wash your hands with a disinfectant soap.
- ✓ It is a large spill and your instructor and the Biology Department Safety Officer are not available, then call the UMD Department of Environmental Health and Safety.
- ✓ Each lab is equipped with a spill response kit.

Biosafety Levels and Practices

The Centres for Disease Control (DC) and the National Institutes of Health (NIH) have developed standard procedures providing protection against biological hazards. The publication, Biosafety in Microbiological and Biomedical Laboratories (http://www.cdc.gov/0D/obs/biosity/bmbl4/bmbl4toc.htm), provides specific descriptions of microbiological practices, laboratory facilities, and safety equipment, and recommends their use in four biosafety levels (BSLA). Biosafety levels are selected to provide the end-user with a description of the minimum containment required for handling different microorganisms safely in a laboratory setting and reduce or eliminate exposure to potentially hazardous agents. Containment refers to sale methods for managing infections material in the laboratory environment. These biosafety levels are applicable to facilities such as diagnostic, research, clinical, teaching, and production facilities that are working at a laboratory scale. The lour biosafety levels are described as

Biosafety Level 1 (BSLI) Examples of BSLI Agents Bacillus Subtilus, Naegleria gruberi, many Escherichia coli, Infectious Canine Hepatitis Virus

- ✓ BSLI containment is suitable for work involving well-characterized agents not known to cause disease in healthy adult humans, and of minimal potential hazard to laboratory personnel and the environment.
- ✓ A BSLI lab requires no special design features beyond those suitable for a well-designed and functional laboratory.
- ✓ Biological safety cabinets (BSCs) are not required. Work may be done on an open bench top, and containment is achieved through the use of practices normally employed in a basic microbiology laboratory.

Biosafety Level 2 (BSL2) Examples of BSL2 Agents: Bacillus anthracis, Bordetella pertussis, Brucella spp. Cryptococcus neoformans, Clostridium botulinum, Clostridium tetani, Helicobacter pylori, mast Salmonella spp. Yersinia pestis. Myrobacterium Iepene, Shigella spp., Human

Immunodeficiency Virus, Human blood

- ✓ The primary exposure hazards associated with organisms requiring BSL2 are through the ingestion, inoculation and mucous membrane route.

- ✓ Agents requiring BSL2 facilities are not generally transmitted by airborne routes, but care must be taken to avoid the generation of aerosols (aerosols can settle on bench tops and become an ingestion hazard through contamination of the hands) or splashes.

- ✓ Primary containment devices such as BSCs and centrifuges with sealed rotors or safety cups are to be used as well as appropriate personal protective equipment (ie, gloves, laboratory coats, protective eyewear).

- ✓ Environmental contamination must be minimized by the use of hand washing sinks and decontamination i (autoclaves).

Biosafety Level 3 (BSL3) Examples of BSL3 Agents: Myobacterium tuberculosis, Salmonella typhi, Vesicular Stomatitis Virus, Yellow Fever Virus, Francisella tularensis, Coxiella burnetti

- ✓ Laboratory personnel have specific training in handling these pathogenic and potentially lethal agents and are supervised by scientists who are experienced in working with these agents.
- ✓ These agents may be transmitted by the airborne route, often have a low infections dose to produce effects and can cause serious or fife-threatening disease.
- ✓ ISL3 emphasizes additional primary and secondary barriers to minimize the release of infectious organisms into the immediate laboratory and the environment.
- ✓ Additional features to prevent transmission of BSL3 organisms are appropriate respiratory protection,
- ✓ A filtration of exhausted laboratory air and strictly controlled laboratory access.

Biosafety Level 4 (BSLI) Examples of BS15 Agents: smallpox virus, Ebola virus, hemorrhagic fever viruses

- ✓ This is the maximum containment available and is suitable for facilities manipulating agents that are dangerous/exotic agents, which post a risk of life threatening disease.
- ✓ These agents have the potential for aerosol transmission, often have a low infectious dose and produce very serions and often fatal disease, there is generally no treatment or vaccine available.
- ✓ This level of containment represents an isolated unit, functionally and, when necessary, structurally independent of other areas.
- ✓ ESLA emphasizes maximum containment of the infections agent by complete sealing of the facility perimeter with confirmation by pressure decay testing, isolation of the researcher from the pathogen by his or her containment in a positive pressure suit or containment of the pathogen in a Class III BSC line, and decontamination of air and other effluents produced in the facility.

ANNEXURES IV
PHARMACOLOGY AND PHYSIOLOGY LAB SAFETY MANUAL

Blood Body Fluid Exposure Procedure:

- ✓ If a Blood/Body Fluid Exposure (BBFE) has occurred, it is important that immediate steps are taken to determine the significance of the injury and whether follow-up is necessary.

Information for the Affected Person:

- ✓ Wash the affected area immediately with soap and water.
- ✓ If cuts and abrasions are involved they should be included in the washing.
- ✓ For eye splashes rinse gently but thoroughly with water or normal saline, while the eyes are open.
- ✓ If blood gets in the mouth, spit it out and rinse the mouth with water several times.
- ✓ Alcohol based rinses or foams should be used if water is not available.

GUIDELINES FOR LABORATORY SAFETY:

- ✓ Always be conscious of the potential hazards: Keep evacuation routes clear at all times.
- ✓ Be aware of emergency evacuation procedures.
- ✓ Head the label on all substances used in the laboratory and follow the warnings. If in doubt, ask your Supervisor.
- ✓ Follow sale working procedures at all times Store the minimum quantities of substances in the laboratory,
- ✓ Always use a fume cupboard for handling hazardous or volatile substances.
- ✓ Wear appropriate attire.
- ✓ Appropriate closed footwear shall be worn in laboratory areas at all times, by all persons.
- ✓ Avoid working alone in the laboratory especially if: (1) the procedure is particularly hazardous and/or (2) the procedure is performed after normal working hours.
- ✓ Washing of hands when leaving the laboratory is recommended.
- ✓ Mechanical pipetting devices should be used for all pipetting procedures.
- ✓ Gas cylinders must be secured in an upright position.
- ✓ Keep the laboratory in a clean and tidy state.
- ✓ It is good practice to clear the bench at the end of each day.
- ✓ Avoid using glassware that is chipped, broken, cracked or badly scratched.
- ✓ Take care in using cryogenic fluids or dry ice for cooling.

STANDARD AND ADDITIONAL PRECAUTIONS FOR INFECTION CONTROL:

- ✓ Infection Control recommends that all staff adopt Standard Precautions (formerly known as Universal Precautions) as the primary strategy for prevention of hospital-acquired infection.

- ✓ Standard Precautions are designed to protect both patients and workers from blood (including dried blood), all other body fluids, secretions and excretions (excluding sweat), non-intact Skin and mucous membranes through handwashing, use of personal protective equipment (PPE), aseptic practices, sale disposal and handling of potentially infectious material, the appropriate reprocessing of instruments and equipment following use and environmental controls.

Hand washing:

- ✓ Hands must be washed after contact with blood, body fluids and contaminated items, whether or not gloves are worn; immediately after gloves are removed; between patient contacts, and when otherwise indicated to avoid transfer of micro-organisms to other patients or environments.

Gloves:

- ✓ Non sterile, single-use examination gloves must be worn whenever there is a risk of direct contact with blood, body fluids, mucous membranes, non-intact skin or contaminated equipment or surfaces.
- ✓ Single use gloves must be discarded immediately after use and changed as soon as they are torn or punctured.
- ✓ Wearing gloves does not replace the need for handwashing.
- ✓ General-purpose utility gloves to be used for cleaning and during manual decontamination of used instruments and equipment.
- ✓ Utility gloves may be reused.
- ✓ Wash after use in detergent and water and store dry.
- ✓ Replace if glove integrity changes.
- ✓ All gloves are discarded into general waste.

Gowns, masks, eye protection, face shields:

- ✓ Wear gowns, masks, eye protection and/or a face shield during procedures and patient care activities that are likely to generate splashes or sprays of blood, body fluids, secretions and excretions.

- ✓ Adequate Footwear: Footwear should be capable of protecting clinical health care workers from injury or contact with sharp objects.
- ✓ Sale disposal and handling of sharps: Take care to prevent injuries when using needles, scalpels, and other sharp instruments or devices. Sharps are classified as medical waste.
- ✓ Patient care instruments/equipment: Ensure that reusable equipment is not used for the care of another patient until it has been cleaned and reprocessed appropriately (see Infection Control manual),
- ✓ Environmental controls: There should be regular cleaning schedules to maintain a safe patient and stall environment.
- ✓ A neutral detergent is the cleaning solution of choice for environmental surfaces.

Chemical Spill:

Evacuate

- ✓ Leave the spill area; alert others in the area and direct/assist them in leaving.
- ✓ Without endangering yourself: remove any victims to fresh air, remove contaminated clothing and flush contaminated skin and eyes with water for 15 minutes If anyone has been injured or exposed to toxic chemicals or chemical vapours, call 911 and seek medical attention immediately.

Confine

- ✓ Close doors and isolate the area.
- ✓ Prevent people from entering spill area.
- ✓ Determine if the spill is within your capability to clean up safely
- ✓ If yes, follow your lab's procedures for spill clean-up. If not, continue on with the remainder of this guide.
- ✓ Report From a sale place, call personnel Be prepared to give your name, phone and location, location of the spill; the name and amount of material spilled; extent of injuries, safest route to the spill
- ✓ Personnel or the Fire Department will clean up or stabilize spills, which are considered high hazard (fire, health or reactivity hazard).
- ✓ In the case of a small spill and low hazard situations, Personnel will advise you on what precautions and protective equipment to use
- ✓ Secure Until emergency response personnel arrive block off the area's leading to the spill, lock doors, post signs and warning tape, and alert others of the spill.
- ✓ Post staff by commonly used entrances to the area to direct people to use other routes

Animal Related Hazards:

Bites and Scratches:

- ✓ Bites and scratches represent a significant portion of laboratory animal associated hazards
- ✓ These injuries are readily preventable through proper animal handling technique.
- ✓ You should always wear a long sleeve lab coat when handling rabbits or larger animal to avoid
- ✓ Scratch injury, and in some cases special gloves (eg, stainless steel mush or heavy leather gauntlets) to prevent bites.
- ✓ Prior to animal handling, eliminate unusual noises, deflective equipment, slippery surfaces and conditions conducive is entrapment or distraction of the animal handler.
- ✓ Inappropriate animal handling may induce discomfort, pain, and distress in the animal. This can provoke a fraction response, introduce undesirable experimental variables, and provide an opportunity for the animal to inflict injury upon the handler.

- ✓ Special attention and training is necessary if you are involved in the handling and restraint of large animals, especially non-human primates.
- ✓ In addition to posing a bite and scratch hazard, non- human primates can be challenging and difficult to handle safely because of their remarkable strength, dexterity, intelligence, and tenacity.
  - ✓ Non-human primates have caused injuries when they have grabbed and pulled neckties, loose-fitting lab coats, or long hair of unsuspecting personnel.
  - ✓ When compatible with the experimental conditions of animal use and/or the clinical condition of the animal, consider chemical immobilization of many non-human primate species to enable safe animal handling and to reduce the risk of injury.
  - ✓ Animal bites continue to be a common occurrence among research personnel, and you should take them seriously even when there is little tissue damage.
  - ✓ Animal bites also prompt a veterinary review of the animal handling circumstances to ensure that you used proper animal handling techniques.
  - ✓ A specific, detailed protocol is in effect for bites, scratches, or mucous membrane exposures involving some monkey species due to the Herpes B virus, an agent that can cause fatal infection.
  - ✓ Other specific viral agents that can be involved as wound contaminants include rabies virus (all mammals). Hantavirus (rodents), lymphocytic choriomeningitis virus (rodents) and orf virus (sheep and goats).
  - ✓ Numerous bacterial agents and at least one fungal agent have also been recorded as wound contaminants resulting in serious localized or systemic infections.

Animal Associated Allergies:

- ✓ An estimated 10 to 30 percent of individuals who work with laboratory animals may eventually develop an allergy to laboratory animals, which is manifested by reddened, itchy eyes, nasal symptoms, and skin rashes. Individuals with pre-existing allergy to other agents have a predisposition to develop an additional sensitivity to animal allergens. Asthma, characterized by cough, wheezing, chest tightness and shortness of breath, develops as a further complication in approximately ten percent (10%) of individuals with animal-associated allergy. Anaphylaxis, a generalized allergic reaction presenting as diffuse itching, hives, and facial and oral swelling, can develop. Anaphylaxis can produce life threatening consequences from laryngeal edema, airway obstruction, and shock in certain individuals with massive allergen exposure, often through saliva.
- ✓ Although rodents, rabbits, and cats are most often incriminated in cases of laboratory animal-
- ✓ Associated allergy, other mammals and birds abo can be involved.
- ✓ Work practices that minimize contact with animal proteins reduce risk for development of allergy-
- ✓ Should wear long sleeve outer garments (eg, lab coat or disposable coverall) to reduce the exposure of skin to urine, dander, and other allergens.
- ✓ Filtering face piece respirators may help reduce the exposure of the respiratory tract to allergen.

- ✓ Personnel with known inhalant allergy should consider the use of a full-face respirator or a powered-air purifying respirator (PAPR), both of which provide ocular as well as respiratory protection.

Zoonosis

Zoonosis are diseases that are transmissible from animals to humans. Laboratory animal species potentially harbour numerous zoonotic agents, including viruses, bacteria, fungi, protozoa and internal and external parasites, but the reported cases of zoonotic transmission to individuals with laboratory animal contact have been infrequent and sporadic. However, many zoonotic disease episodes likely have remained unreported, and those reported involved serious disease and even fatalities. For these reasons, individuals with laboratory animal contact should be aware of these diseases and take appropriate precautionary measures. The following gives examples of major

Rodents and Rabbits

- ✓ The modern conditions of production and care for most laboratory rodents and rabbits have led to the eradication of zoonoses in most of these species. Although contamination of these animals through environmental sources, contact with wild rodents or other infected animals, or through tumours, cell lines, or other biologics used experimentally happens, it is rare. In most circumstances, only wild-caught, laboratory maintained rodents are a high risk for the transmission of zoonotic diseases. Be familiar with several zoonoses associated with rodents and rabbits.
- ✓ Two serious systemic viral zoonoses have been associated with the use of laboratory rodents. Lymphocytic choriomeningitis virus causes a flu-like disease with neurological complications, and Hantavirus infection produces a disease marked by renal failure and respiratory complications. Other than the bite-associated bacterial infections from rodents (e.g., rat-bite lever) there are few bacterial zoonoses in these species. The rabbit is a potential source for human bacterial pathogens, especially those that cause human diarrheal disease such as salmonellosis.
- ✓ Rodents and rabbits are also a source for human ringworm infection, usually recognized as a
- ✓ Reddened, annular lesion of the skin of the affected individual. A similar focal dermatitis results
- ✓ From infestation with rabbit fur mite and, rarely, other mite species of rodents. The dwarf tapeworm
- ✓ Infestation of rodents also is capable of infecting man. The minimal personnel protective equipment

- ✓ recommended for working with small rodents includes particle facemask, latex (or nitrile or other)
- ✓ Disposable gloves, safety glasses and a clean lab coat

Birds and Livestock

- ✓ lever has proven to be an important zoonosis associated with livestock in laboratory animal facilities. Although all ruminants and many other animals are potential carriers, inflection of laboratory personnel has most often been associated with pregnant sheep that copiously shed the organisms. The disease causes a fin-like illness, which can progress to a serious systemic infection with heart involvement. Orf, a pox viral disease of sheep and goats, can also infect humans through contaminated wounds producing firm, nodular lesions. Livestock and birds can harbour bacterial zoonoses causing diarrhoea in humans. Birds also can shed the agent psittacosis (Chlamydia psittaci), a serious respiratory and systemic disease of humans. Proper use of PPE is essential to minimize exposure to these potential zoonotic hazards.
- ✓ Use respiratory protection compatible with that described for the prevention of tuberculosis when working with pregnant ruminants (Q fever) or birds harbouring Chlamydia psillaci.

A more recent, emerging concern is avian influenza virus, with 85:NI virus receiving the most attention, 115:NI virus is an influenza A virus subtype that occurs mainly in poultry and wild birds is highly contagious among birds, and can be deadly to them. H5:NI does not usually infect people, but infections with these viruses have occurred in humans. Most of these cases have not resulted from person-to-person contact, but instead resulted from people having direct or close contact with HS:NI-infected poultry or HS:N1-contaminated surfaces. Therefore, proper handling, sanitation, and use of PPE can prevent transmission of virus from bird to human.

Below are examples of recorded injuries and accidents to personnel working in laboratory animal facilities :

- ✓ Burn injuries due to working around cage washers, autoclaves, or other sources of hot water or livestream
- ✓ Crush injuries or lacerations from moving caging equipment, operating sanitation equipment, or working with intractable large animals
- ✓ Musculoskeletal injuries (strains, sprains or fractures) due to the use of improper technique in lilting or moving heavy equipment, or improper restraint and handling of large animals
- ✓ Slip and fall injuries from walking on wet flooring
- ✓ Hearing impairment resulting from work around loud machinery or animals

- ✓ Visual impairment from direct trauma (equipment), splash exposure (detergents, disinfectants, or particulate matter) or exposure to ultraviolet light resulting in corneal damage
- ✓ Skin irritation or contact dermatitis from exposure to chemicals used in cleaning, latex or tale
- ✓ Allergy, or in experimental procedures in the animal facility
- ✓ Respiratory exposure to irritating vapours, aerosols or particulates from working with disinfectants and bedding materials
- ✓ Needles stick exposures from attempts to recap hypodermic needles, improper injection technique, or delay or improper disposal of used needles

ANNEXURE V

DEPARTMENT OF PHYSICAL EDUCATION

Policy for Play fields and Sports Safety

This policy sets out the responsibilities for health and safety management in Physical Education and Games. It aims to ensure that Sport is offered within a well-managed, safe and educational context. It will help to ensure that the environment is safe for activity and activities are appropriately supervised.

Roles and Responsibilities

A. Safety functions of the Subject Leader

In the day-to-day management of health and safety in Physical Education and Games, theHead of Faculty‘s role is to ensure:

1. There is a clear institutional Health and Safety Policy
2. All staff understands their roles and responsibilities Procedures and systems for ensuring safety exist
3. Policy and procedures are systematically monitored and reviewed There is a smooth flow of health and safety information
4. All staff are fully briefed on health and safety procedures and requirements with all PEand Games staff holding a current first- aid knowledge.
5. There is liaison with Health and Safety Committee and all matters of Health and Safety arereviewed and Health and Safety Committee meetings.
6. Risk assessments are produced and implemented.
7. The competence of staff contributing to the Physical Education programme is monitored.

Safety functions of Sport Faculty, Sports Coaches and support staff

The Sport Faculty, Sports Coaches and support staff should;

1. Take reasonable care of their own ‘trainees‘ and ‘others‘ health and safety whenparticipating in sporting activities.
2. Co-operate with subject coordinator and other authorized personnel over safety matters

3. Carry out their work in accordance with training and instruction
4. Carry out delegated health and safety tasks
5. Follow institutional procedure in reporting any perceived short comings in safetyarrangements
6. Ensure the safe use of all equipment

Efficient information flow

1. Health & safety information is shared with staff where necessary at staff meetings, whichis minute, and referred back to where necessary.
2. The Principal, Administrative Officer, Head of Faculty and other staff that contribute toSports programme are mindful of Health and Safety.

Training for Staff and Sports Coaches

1. Staff new to the institution will receive a Sports Induction which includes routines, roles and responsibilities directly and indirectly involved with Health and Safety, emergency procedures and incident reporting.
2. There will be on-going training for staff where necessary when new equipment or procedures are introduced, to test emergency and accident procedures.

Equipment maintenance

a.Disposal of equipment

Procedures are in place for checking equipment and reporting faults. Any equipment found to be defective is withdrawn from use until repaired or replaced.

b. Purchasing and storage of equipment

1. All items purchased comply with the appropriate standard/approval by taking in to accountthe nature of the usage.
2. All items donated or borrowed from other sources will undergo suitable and sufficienttests before being used.
3. All equipment must be stored safely and securely. Storage areas must be kept tidy and allow safe access for staff and students. The individual member of staff must be responsible for the safe and correct replacement of all equipment/apparatus used in each session.
4. Equipment deemed to be in a defective state and/or unserviceable (‑condemned‖),

where identified by staff and confirmed by the Head of Faculty, is immediately taken out of use, reported to the Principal and correctly disposed of as soon as possible to prevent inappropriate usage

Accident and Emergency procedures

1. The institution has designated trained first aiders
2. In out of hours learning activities, a first aid kit is available and accessible in the Pavilion,Sports Hall and Reception. Emergency contact numbers are also available and accessible.
3. For off-site fixtures/activities, the members of staff will have the institutional phonenumber, direct to college office that then makes relevant contacts.
4. All accidents are recorded in the accident book found in the first aid kit.
5. Pupils suspected of receiving a concussion or a spinal injury during a fixture will not bepermitted back onto the field of play under any circumstances.

Lifting and carrying apparatus and equipment

Staff and pupils are aware of safe practice and regularly updated when lifting and carrying apparatus and equipment.

Staff checks equipment visually at the beginning of each lesson and before children work on apparatus, checking spacing, connection, stability and appropriateness.

Medical Information

1. There is a system for sharing medical information between staff.
2. When staffing sporting activities, staff medical issues are considered and taken intoaccount and relevant support/cover is put in place.
3. Players are aware of their commitments to college sport but if they are previously injuredprior to a fixture, they must declare their ‒fitness‖ to their coach before they can be selected.

Jewellery

2. 1 Pupils and staff should not wear any jewellery, including ear rings/studs when engaged inPhysical Education or college sport (wrist watches may be an exception in some cases).
3. Remove and store with staff or at players‘ own risk

4. If cannot remove then faculty decides if task-situation can be amended to enableparticipation. If not – don‘t take part.
5. Regularly check for body piercings if appropriate
6. When such items are removed, they are stored by the players or in jewellery boxes and arehanded back at the end of the session.

Clothing and footwear

A full description of the PE Kit required can be found in the Physical Education Department

1. Yoga and Gymnasium sessions will be done in bare feet, where the floor surface is suitable. Students are not allowed to work in socks. Where barefoot work is not possible
2. students will wear trainers or similar soft-soled footwear.
3. Students with verrucae should keep them covered and wear suitable footwear. Long hair should be tied back; chewing gum and sweets are not allowed under any circumstances. Headscarves must be secured safely.
4. Religious adornments etc must be removed or made safe. If removal is expressly forbidden and the article cannot be made acceptably safe by taping, padding or covering, theactivity and involvement of the student will be suitably modified to mitigate undue risk.
5. Staff will dress appropriately for the activities being taught. As a minimum requirement, staff will wear appropriate footwear and remove jewellery (wrist watches may be an exception is some cases).

Oganisation of off site visits (including inter- collegiate fixtures and competitions)

1. The general requirements for Educational Visits apply to physical education orschool sport events not on the school site. The school procedures for off site visits should be followed.
2. The host college/ club/facility are responsible for completing the risk assessment for the activity. Prior to the event, our member of staff in charge will make themselves familiar with any implications of the host college assessment, clarify any issues with the host and ensure that the players (and parents where

necessary) are made aware of any procedures to make the situation safe.

Risk Assessment

1. Risk assessment is carried out for Physical Education and college sport activities in line with the whole college policy. Risk assessments are reviewed annually. Risk assessments should be in place for:

- The sports hall
- The field
- The playgrounds
- Off-site risk assessment documents should be made available to the member of staff where appropriate.

FIRST AID

First Aid is the immediate and temporary treatment of a victim of sudden illness or injury while awaiting the arrival of medical aid. Proper early measures may be instrumental in saving life and ensuring a better and more rapid recovery. The avoidance of unnecessary movement and over-excitation of the victim often prevents further injury. Conditions that require immediate attention to avert death include cessation of breathing (asphyxia), severe bleeding, poisoning, strokes, and heart attack. The essentials of first aid treatment also include the correct bandaging of a wound; the application of splints for fractures anddislocations; the effective methods of cardiopulmonary resuscitation (CPR) and artificial respiration; and treatment of shock, frostbite, fainting, bites and stings, burns, and heat exhaustion.

Principles of First-Aid

1. To Preserve life
2. To prevent the condition worsening
3. To promote recovery

Asphyxia and Obstruction of Air Passages

Symptoms: Blue discoloration of face, tongue, and lips; gasping; inability to speak; unconsciousness. Treatment: First try the Heimlich maneuver, grasping the victim from behind with hands linked in front and compressing the abdomen just below the ribs. Encourage victim to cough up foreign objects in throat; as a last resort, rap victim between shoulder blades to dislodge object. For asphyxia caused by gas or fumes, remove victim to a

clear atmosphere; use artificial respiration.

Fainting

Symptoms: Unconsciousness, paleness, rapid pulse, coldness of the skin, sweating. Treatment: Leave victim lying down, loosen clothing, roll victim to the side and wipe out mouth in the event of vomiting.

Foreign Body in the Eye

Symptoms: Pain, redness, burning, tears. Treatment: Pull down lower lid and remove object with clean tissue if it lies on the inner surface of lower lid. If object has not been located, pull upper lid forward and down over lower lid. Object can be removed from surface of upper eyelid by turning lid back over a swab stick or similar object and lifting off the foreign body with a clean tissue. Finally, flush the eye with water. If object is suspected to be embedded, apply a dry, protective dressing over eye, and call physician or take patient to hospital emergency room. Keep victim from rubbing the eye. For chemical burns, flood eyes with water.

Fractures and Joint Injuries

Symptoms: Pain or tenderness, deformity of bones, swelling, discoloration. Treatment: Prevent movement of injured parts until splint is applied; treat for shock; if ambulance service is not available, splint entire limb before moving. For sprains, elevate affected part and apply cold compresses. Elastic bandages may be used for immobilization.

Heat Exhaustion

Symptoms: Pale, clammy skin, profuse perspiration, weakness, headache, possibly cramps. Treatment: Rest, cool atmosphere, cool water by mouth if conscious. In case of heat cramp, exert firm pressure on cramped muscle (usually abdomen or legs) to help relieve spasms.

Heatstroke

Symptoms: High temperature (as high as 108–112°F;/42–44°C;), hot dry skin, rapid pulse, possibly unconsciousness. Treatment: Immediately undress victim and sponge with or immerse in cool water or wrap in water-soaked sheets. Use fan or air conditioner.

Severe Bleeding

Symptoms: External wound. Treatment: Apply pressure over wound with wad of sterile gauze or other clean material. If bleeding continues and no fracture is present, elevate wound. If bleeding still continues, apply pressure to blood vessels leading to area—in arm, press just below armpit; in leg, press against groin where thigh and trunk join. Use a tourniquet (tight band that cuts off circulation) only when it has been decided that the sacrifice of a limb is necessary to save life.

Wound

Treatment: Stop bleeding, cleanse wound with soap and water and cover with sterile or clean bandage

Call for the assistance of a Physician

After providing first-aid the bystander or the witness must seek the assistance from others and call for an ambulance and take the victim to hospital as soon as possible for better medical assistance.

Burns

Symptoms: Redness (first-degree burns), blistering (second-degree burns), charring of skin (third-degree burns). Treatment: Cold water may be applied to first- and second-degree burns. All burns should be covered with sterile non-adherent dressings. Chemical burns should be washed with large quantity of water; vinegar may be added to the water for alkali burns, and sodium bicarbonate may be added to the water in case of acid burns.

ANNEXURE- VI
SAFETY IN THE LIBRARY

COLLEGE LIBRARY

- Libraries need to have safety and security plans to ensure that staff are prepared to face and act during fire, water emergencies and other major threats to collections..

Regular Inspection of the Building

The inspection of the building should be done regularly as a precautionary measure. The Inspection should cover both the building and the materials there in. This shall help to detect any faulty equipment, decay or leakage in the walls and thus avert major damages.

Dealing with emergencies

Fire

1. Pull the fire alarm (the appropriate fire and rescue services should be automatically alerted).
2. Follow the emergency evacuation plan for the library.
3. Notify the institution's safety officer and contact the staff members in the telephone

Taking precautions against theft

Protecting the collection should include ensuring good security to prevent theft. This is especially a concern when libraries must provide remote storage for overflow materials or special vulnerable materials such as CDs/ rare books etc

General Issues

To ensure that library is a safe place for all the students and teachers

Store the heaviest load in the lower drawers/shelves. Make sure that the structure is not unstable.

Do not store more than the load capacity of the cupboard or cabinet.

Arrange the contents in an orderly manner.

Avoid storage on top of cupboard

ANNEXURE VII

COLLEGE HOSTELS, CANTEEN AND CAMPUS BUILDINGS

Safety regulations for TIST hostels

A few points towards ensuring safety of hostel inmates are given below.

- ✓ Candles and incense sticks are fire hazard and are not permitted in the hostels. Combustible materials such as gasoline, paint thinner and oil lamps are not permitted in the hostels. Burning/bursting of crackers, carrying of crackers to the rooms and lighting of lamps/candles are banned strictly in and around the hostel premises throughout the year. Residents must switch off all lights and fans, and electrical appliances including mosquito repelling machines if any before leaving their rooms. This is necessary to avoid an inadvertent fire.
- ✓ Keeping of lethal weapons like sticks, rods, chains etc. in the hostel rooms is strictly prohibited.
- ✓ The use of motor vehicles such as Car, Motor cycle, Scooters, Mopeds, etc. by students is strictly prohibited inside the college/hostel premises.
- ✓ Use of all unauthorized electrical appliances such as heaters etc. is strictly prohibited in the hostel rooms.
- ✓ Every student residing in the hostel must dine in the hostel messes only. Individual/group cooking in the rooms is forbidden.
- ✓ Hostel inmates are requested to maintain their surroundings neat and clean to avoid insect and snake bites.
- ✓ Any formation of beehives in and around the campus to be informed as soon as possible to the concerned authorities in the college.
- ✓ Regular hygiene check in canteen to be carried out by the safety committee.
- ✓ First aid facility with the vicinity of playground to be functional during any games and training.
- ✓ Housekeeping in and around the college buildings to be strictly maintained so that reptiles and snakes are kept away.
- ✓ Speed limit is kept at 20 Km/hr for all vehicles passing through college campus.
- ✓ Vehicles with modified silencers are not permitted inside the campus to avoid noise pollution.

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