Year 2021-2022

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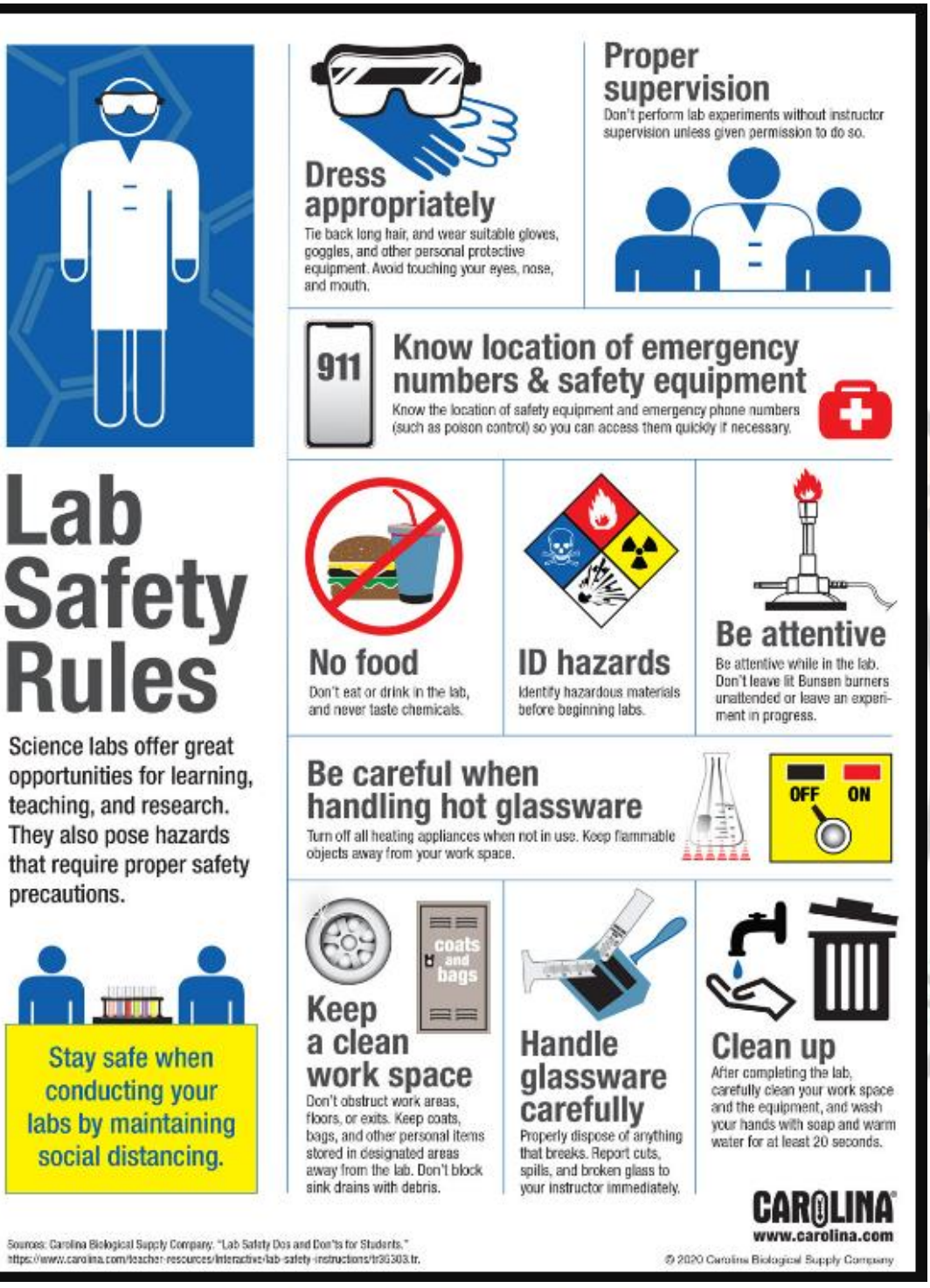
General Guidelines:



General Biotechnology laboratory safety Guidelines:

1. Conduct yourself in a responsible manner at all times in the laboratory.

2. No student may work in the laboratory without an instructor present.

3. Open cuts and wounds **MUST** be bandaged before you enter the lab.

4. **NEVER** bring food or beverages into the laboratory. Do not eat food, drink beverages, or chew gum or tobacco in the laboratory. Do not use laboratory glassware as containers for food or beverages.

5. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ask the instructor before proceeding.

6. Perform only those experiments authorized by the instructor. Never do anything in the laboratory that is not called for in the laboratory procedure or by your instructor. Carefully follow all instructions, both written and oral. Unauthorized experiments are prohibited.

7. Be prepared for your work in the laboratory. Read all procedures thoroughly before entering the laboratory.

8. Never fool around in the laboratory. Horseplay, practical jokes and pranks are dangerous and are prohibited.

9. Work areas should be kept clean and tidy at all times. Keep the aisles clear. Keep lab tables clear of clutter.

10. Know the location and operating procedures of all safety equipment including the first aid kit, fire extinguisher. Know where the fire alarms and exits are located.

11. Dispose of all biological waste properly. Sinks are to be used only for water and those solutions designated by the instructor. Matches, filter papers and all other

insoluble material are to be disposed of in proper waste containers, not in the sink.

12. Labels and equipment instructions must be read carefully before use.

13. Keep hands away from face, eyes, mouth and body while working in microbiology laboratory. Wash your hands with soap and water before and after performing all experiments. Clean with disinfectant, and wipe dry all work surfaces and apparatus at the end of the experiment. Return all equipment clean and in working order to the proper storage area.

14. **ALWAYS** disinfect your bench top **BEFORE AND AFTER** each laboratory session.

15. **ALWAYS** wash your hands before beginning your work **AND** at the end of each laboratory session before leaving the room.

Guidelines for hazardous materials:

Hazardous Materials Safety Guide

CLASS	STORAGE	HAZARD	PPEs
 Flammable	Segregate Storage	Ignite Easily and Burn Rapidly	
 Corrosive	Store Away From Flammable, Reactives and Health Hazards	Causes Tissue Damage on Contact	
 Reactive	Store Away From Corrosives, Health Hazards and Flammables Hazards	Reacts Violently with Air, Water and Other Substances	
 Health Hazard	Secure Storage in Well Ventilated Stockroom	Toxic if Inhaled, Ingested or Absorbed Through The Skin	
Non Hazardous	Secure Storage in Well Ventilated Stockroom	Presents No More Than a Moderate Hazard	Supervisor's Discretion
 Particularly Hazardous Substances	Carcinogens, Highly Toxic Chemical, and Reproductive Toxins Require Special Precautions. • Develop Standard Operating Procedures (SOPs). • Establish a Designated Work Area. • Use PPEs and Fume Hoods to Control Exposure. • Establish Decontamination and Emergency Response Procedures.		

Guidelines for disposal of biohazardous materials:

SOPs for handling hazardous materials:

Personal Protective Equipment (PPE): Wear appropriate PPE such as gloves, lab coat, goggles, respirator, etc. depending on the type of hazardous material being handled.

Labeling: All hazardous materials must be properly labeled with the appropriate hazard symbols, warnings, and storage instructions.

Storage: Store hazardous materials in appropriate locations, such as designated chemical storage cabinets, and away from incompatible materials.

Handling: Always handle hazardous materials with care and follow the manufacturer's instructions for safe handling and disposal.

Spills: In case of a spill, use appropriate spill control measures, such as absorbent materials, to contain and clean up the spill. Never use water to clean up flammable or reactive chemicals.

Disposal: Follow the proper disposal procedures for hazardous materials, including labeling, containment, and storage prior to disposal.

Emergency response: Know the location and use of emergency equipment such as fire extinguishers, eyewash stations, and shower facilities. Develop and practice emergency response procedures for spills, fires, and other incidents involving hazardous materials.

Training: Provide appropriate training to all laboratory personnel on the safe handling, storage, and disposal of hazardous materials.

Laboratory SOP for discarding biohazardous materials in a scientific laboratory:

Identification and Segregation: Identify and segregate the biohazardous waste from non-hazardous waste generated in the laboratory. Use appropriate containers, such as biohazard bags or containers with biohazard symbols, to store the biohazardous waste.

Autoclave: Autoclave the biohazardous waste using a validated sterilization process. Ensure that the waste is placed in an appropriate autoclave bag and that the bags are not overloaded. Follow the manufacturer's instructions for operating the autoclave.

Decontamination: After the autoclaving process is complete, allow the waste to cool down before handling. Once cooled, open the autoclave bag and visually inspect the contents to ensure they are sterilized. If any items are not sterilized, re-autoclave them.

Disposal: Once the biohazardous waste has been sterilized, it can be safely disposed of in the laboratory's regular trash or as directed by local waste management regulations. Ensure that the waste is properly labeled as "decontaminated" and dispose of it in a way that will not pose a risk to human health or the environment.

Recordkeeping: Keep accurate records of all biohazardous waste generated and disposed of in the laboratory. Maintain a log of all autoclave runs, including date, time, temperature, and duration of the sterilization cycle. Keep copies of waste disposal certificates.

Training: Train all laboratory staff on the proper handling and disposal of biohazardous waste. Ensure that they understand the SOPs and the importance of following them. Provide refresher training as necessary.

Guidelines to be followed for during bench-work:

1. Clothing:

1. Any time microorganisms, chemicals, heat or glassware are used, students will wear protective covering such as a lab coat to safeguard your body/clothing. **There will be no exceptions to this rule!**
2. Contact lenses should not be worn in the laboratory unless you have permission from your instructor.
3. Wear proper attire at all times in the laboratory:

- Avoid loose or baggy clothing, dangling jewelry, etc.
- Remove your foot-wares outside the laboratory.
- Long hair must be tied back.

2. Accidents and Injuries:

1. **Report any accident** (spill, breakage, etc.) or injury (cut, burn, etc.) **to the instructor immediately**, no matter how trivial it may appear.

2. If you spill or drop a culture, after notifying the instructor, place a paper towel over the spill and pour disinfectant on the towel. Wait for 15 minutes then clean the spill with fresh paper towels. Remember to place paper towels in wastebaskets and wash your hands carefully. Dispose of any broken glass properly.

3. Handling of Bacteria and Chemicals:

1. All bacteria and chemicals in the laboratory are to be considered dangerous. Do not touch, taste or smell any bacterial culture or chemical unless specifically told to do so.
2. For bacteria or chemicals ingested, see the lab instructor immediately.
3. Check the label on cultures and chemical bottles twice before removing any of the contents. Take only as much of the bacterial culture or chemical as you need.
4. Never return unused chemicals to their original containers.
5. Never use mouth suction to fill a pipette. Use a rubber bulb or pipette pump. Always keep the pipette pointed away from your body.
6. Never dispense flammable liquids such as ethanol anywhere near an open flame or source of heat.
7. Never remove bacteria, chemicals or other equipment from the laboratory.
8. Take great care when transporting cultures and chemicals from one part of the laboratory to other.

Hold them securely and walk carefully. All cultures should be in a test tube rack.

4. Handling Glassware and Equipment

1. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Place broken or waste glassware in the designated glass disposal container. If it is contaminated, it must be autoclaved first. Notify the instructor.
2. Examine glassware before each use. Never use chipped or cracked glassware. Never use dirty glassware.
3. Do not immerse hot glassware in cold water or put it directly from a hot plate to the cooler countertop; it may shatter.
4. Report damaged electrical equipment immediately. Look for things like frayed cords, exposed wires and loose connections. Do not use damaged electrical equipment.
5. If you do not understand how to use a piece of equipment, ask the instructor for help.

5. Heating Substances

1. Exercise extreme caution when using a gas burner. Take care that hair, clothing and hands are a safe distance from the flame at all times. Never reach over an exposed flame.

2. Never leave a lit burner unattended. Never leave anything that is being heated unattended. Always turn the burner or hot plate off when not in use.

3. Heated metals and glass remain very hot for a long time. They should be set aside to cool and picked up with caution. Use tongs if necessary.

4. Determine if an object is hot by bringing the back of your hand close to it prior to grasping it.

6. Disposal

1. Discard all cultures, petri-plates, and used glassware in the container labeled **contaminated** or **biohazard**. This container will later be autoclaved.

2. **NEVER** place contaminated pipettes on the bench top.

3. **NEVER** place contaminated inoculating loops on the bench top.

4. **NEVER** discard contaminated cultures, Petri dishes, glassware, pipettes, tubes, or slides in the trash can.

5. **NEVER** discard contaminated liquids or liquid cultures in the sink.

Glassware washing:

PROCEDURE:

1. Whenever glassware is used for microbiological analysis, dispose the inoculated media, at the end of the incubation period.

2. After disposal of the media, dip all the infected glassware in 3% v/v Dettol solution for 30 minutes.

3. Rinse with water and dip it in a 3% v/v solution of teepol for one hour.

4. Brush all the glassware.

5. Rinse the glassware continuously with running tap water till there are no traces of teepol solution left and, finally, rinse with purified water.

6. After washing, dry all the glassware in an oven at 120°C for 60 mins.

7. Keep the pipettes and Petri dishes in their respective stainless steel containers.

8. Sterilize the glassware by autoclaving at 15 lbs pressure (121°C) for 15 minutes.

9. Once in a month, dip the glassware, in the chromic acid mixture, overnight. While handling chromic acid mixture, use rubber gloves, remove the glassware carefully from the chromic acid mixture.

10. Rinse the glassware thoroughly with tap water, as the glass tends to absorb chromic acid, and finally, rinse with purified water.

BENCHTOP CENTRIFUGE

- Make sure that the rotor is appropriate for the instrument and use the lid that matches the rotor.
- Make sure sample tubes are appropriate for the speed required and also suitable for containing your samples.
- Check tubes for signs of stress and/or crack. Discard tubes if found.
- Place the rotor onto the spindle. Make sure there is no tilting. Make sure the rotor falls between the pins (not on top of them).
- Balance all samples to be within 0.05-gram difference.
- Dry the outside of all tubes with a paper towel and insert them in a balanced way into the SS-34 rotor.
- Close the centrifuge chamber lid, and set the rotor name to S$-34 first, then speed, time, and temperature.
- Press the start button, stay, and observe until the desired speed is reached. Make sure no loud noise or vibration is detected. If abnormal noise or vibration is detected, press the stops button and recheck everything.
- When centrifugation is done, the centrifuge will alarm to indicate the completion. Open the centrifuge lid, loosen the rotor lid, take out a sample, and remove the rotor. Turn off the power. Leave the centrifuge lid open to allow drying.
- The clean rotor in case of a spill. Wipe the centrifuge with a paper towel.

COLONY COUNTER

Objective: The purpose of this SOP is to lay down the procedure for the Operation and Calibration of the Colony Counter.

- Clean the instrument with alcohol before the operation starts.
- Place the instrument in a clean and dry place. Switch ON the power switch of the instrument.
- Ensure that the marker is connected to the instrument.
- Read the digital screen display, it should be "0000" If not then do it by pressing the reset button manually.
- Now place the Petri dish in an inverted position on the instrument platform to count the colonies by marking each colony using colony counter pen.
- The number of colonies will be counted and displayed on the screen.

pH meter

Calibration

- Calibrate the pH meter according to the manufacturer's instructions.
- All standards and samples are brought to 25 ºC before use.
- All standardizations are preceded by rinses with material to be used for calibration.
- A pH 7.0 buffer is placed on the apparatus and the stand key is pressed.
- When the meter so indicates, rinse the apparatus with reagent water and then buffer 10.
- A pH 10.0 buffer is placed on the apparatus and the slope key is pressed.
- The meter will indicate when the standardization is complete.

Analytical Procedure

- All samples and standards are brought to 25℃ ºC before use.
- Rinse the electrodes and other equipment contacting the sample with reagent water.
- Pour an aliquot of sample into a suitable container. Place the sample onto the stirrer and electrode and stir it moderately rapidly without breaking the surface.
- When the meter stabilizes, record the pH reading. Analyze control standards in the same manner.
- When all measurements are complete, store the electrode in a pH 7.0 buffer.

COLORIMETER

- Switch on the colorimeter by switch.
- Wait for 2 minutes until the fluctuation will not stop.
- Set the % Transmittance and Absorbance at zero.
- Take the cuvette and clean it very properly. There should not be any trace on the surface of the cuvette.
- Fill the amount with liquid in the cuvette that we are going to measure.
- Place the light shield in the box (Black in color).
- Place the cuvette very slowly in the cuvette chamber.
- Wait for 1 minute and note down the optical density of the given liquid material
- Switch off the instrument.
- The colorimeter should not be stored or used in a wet or corrosive environment, Care should be taken to prevent water from wet colorimeter tubes from entering the colorimeter light chamber.

Optical microscope

- Location for use: Avoid the following conditions- dust, vibration, and exposure to high temperature, moisture, or direct sunlight.
- Use the coarse adjustment only with the low power objective.
- Clean all oculars and objectives with lens paper and 70% ethanol after each use. Use a soft brush to remove dust.
- Move or transport the microscope with one hand under the base and the other hand gripping the arm.
- Avoid jarring or bumping the microscope.
- Use oil each time the oil immersion lens is used. Use immersion oil with the oil immersion objective only.
- Store the covered microscope in a protected area. Cover with vinyl cover and store in a place free from moisture, dust, and fungus.
- Since bulbs are expensive and have a limited life, turn the illuminator off when you are done. When replacing a bulb or fuse, be sure to turn off the power switch and disconnect the power source cord from the socket.
- Never attempt to dismantle the microscope, to avoid the possibility of impairing the operational efficiency and accuracy.
- To maintain the performance of the instrument the microscope is serviced regularly, e.g. annually.

ELECTROPHORESIS APPARATUS

- Set up the electrophoresis apparatus and turn on the drying oven.
- Fill each of the chambers with 95mL of the electrophoresis buffer.
- Remove the agarose gel from its package. Handle the gel by its edges using the forceps and place its gel side up on a clean flat countertop.
- Fill each sample well with 1 ul of the serum to be tested.
- Allow 2 minutes for the samples to soak evenly into the wells.
- Insert the agarose film into the electrophoresis cell cover, agarose side up, matching the (+) and (-) signs on the cell cover with those on the gel.
- Connect to the power supply, processing it at 90V for 35 minutes.
- Following electrophoresis, remove the gel from the cover, without inverting and place it on a flat paper towel to drain.
- Transfer the gel to a container of amido black B10 stain for 10 minutes.
- Place the gel in a container containing 5% v/v glacial acid for 30 seconds.
- Remove the gel from the tray, wipe away any excess fluid, and then incubate the gel in the drying oven at 55°C for 15 minutes.
- Repeat step 10 two more times, each time using a fresh 5% v/v glacial acetic acid for one minute each time.
- Dry the gel in the oven at 55 C for 20 minutes and view the bands (Five distinct bands should be observed)
- Use the densitometer to make a tracing of the bands.

DIGITAL WATER BATH

- This is a "Do Not Exceed" temperature setting for your Water Bath and is the temperature at which the heater will be turned OFF should the liquid level in the bath drop too low or the Water Bath malfunction
- It is normally set about 59 higher than the desired operating temperature. The Safety Set temperature is adjusted as follows:
- Using a flat-blade screwdriver, rotate the Safety Thermostat clockwise until it stops.
- Turn the power to the controller ON by pressing the Power Button.
- Press the Set/Menu Button. The set point will be displayed and the decimal point will flash.
- Press the Selection Buttons to adjust the set point temperature to the desired safety set temperature and press the Set/Menu Button to accept the new temperature value.
- Once the bath temperature has stabilized at the desired value, slowly rotate the Safety
- Thermostat counter-clockwise until the Safety Indicator lights turn ON.
- Slowly rotate the Safety Thermostat clockwise until the Safety Indicator light turns OFF. Fill the bath so that the liquid level is approximately one inch (2.54 cm)) Tom from the top when samples are placed in the bath.
- To ensure accurate reading of temperature, the fluid level should not be less than 2 inches (5.08 cm) from the bottom of the unit. Operation of the bath without fluid will not damage the heater but will cause permanent discoloration of the tank and will not provide accurate temperature information.
- Distilled water is preferred for temperatures from 100°C to 90°C.

MICROWAVE OVEN

- Do not operate the oven if it is damaged or does not operate properly. The oven door must close properly and there must be no damage to the door seals, sealing surfaces, hinges, and latches
- Do not heat up or produce combustible or flammable materials in the oven. Fire and/or explosives might result. Do not heat up low-boiling point solvents or reactants in the oven.
- Do not heat up sealed containers inside the oven as they may explode damaging the oven and blowing off the door
- No chemical with a penetrating odor, considered a health hazard, or having a TL V -50 ppm, can be used or potentially be produced inside this oven.
- Do not use Aluminium Foil or any metal containers, utensils, or objects with metallic trim, inside the oven.
- Do not heat materials in cylindrical-shaped containers since it may lead to liquid overheating. Liquids if overheated may splatter during or after the heating cycle causing employee injury or damage to the oven.
- If materials inside the oven ignite KEEP the OVEN DOOR CLOSED, turn the oven OFF, and disconnect the power cord.
- When removing containers from inside the oven use proper gloves as well as eye/face protection,
- Do not leave the oven unattended while in use. Never make adjustments or tamper with any component of the oven. Do not try to perform any repairs Seek qualified help or service.
- The Does and Don'ts of Using Microwave Ovens
- To find out how much time is needed to produce the effect you need, for a given size of material.
- Clean up all spills immediately - material e.g, agar will if left dry and then burn.

UV TRANSILLUMINATOR

1. Keep a gel casting tray on the UV transilluminator.
2. Put the cabinet and filter over the gel casting tray.
3. Switch on the UV transilluminator.
4. Adjust the UV intensity high or low by using a knob.
5. Observe the results from the top of the cabinet.
6. Switch off the UV transilluminator.
7. Remove samples.
8. Clean the surface of the UV transilluminator if needed.

INCUBATORY SHAKER

Objective : Incubator shakers are used for the growth of liquid cultures. No direct hazards are presented by proper and safe usage. The most prevalent possible hazard is spills and breaking of culture vessels, resulting in broken glass and damage to the instrument hardware.

- Ensure that the door is closed and that the incubator is switched on.
- Set the required temperature using the temperature control and leave the incubator running for 1 hour.
- Place a thermometer in the center of the incubator with the probe away from the heating element.
- Close and lock the lid. Set power to ON
- Set the shaker ON and adjust the speed control until the desired RPM is reached.
- Set the heater switch ON, and adjust the thermostats. The safety tabs need to be pressed in a while adjusting the temperature. Set the control thermostat to the temperature you want. Please note that the temperature graduations do not necessarily conform to that temperature. Set the safety thermometer to 2 degrees higher. Please wait until the temperature in the incubator stabilizes.

- When it is desired to remove glassware from the inside of the incubator, simply open the door and remove (while wearing gloves) the desired glassware. A safety switch in the hood.

LAMINAR AIRFLOW

- **The laminar flow bench is designed to be run continuously to maintain clean conditions.**
- **Turn on the cabinet blower and light, note that fluorescent and UV lamps will not work simultaneously. It is recommended that the germicidal UV lamp be run for 15-20 minutes prior to using the bench. Check air intake ports for obstructions.**
- **If the bench is turned off, the face of the protective screen should be cleaned by brushing, the interior surfaces wiped with a mild detergent, and the blower allowed to operate for at least 15 minutes prior to using the bench.**
- **Cabinets with UV lights must be turned off during the day when personnel occupy the room. The good procedure includes decontamination of the cabinet by wiping it down with disinfectant prior to commencing work.**
- **Minimize room activity, unnecessary activity (even walking past the cabinet) may create disruptive air currents.**
- **Allow only essential items to be placed in the workstation. Objects should not be placed between the HEPEX and any point where the clean environment must be maintained.**
- **Use proper attire, lab coat, mask, and gloves.**

COOLING CENTRIFUGE

1) Switch on the cooling centrifuge.

2) Fill centrifuge tubes; place them in a well balanced manner.

3) Close the lid.

4) Adjust the timer for the required time.

5) Set the required temperature.

6) Set required r.p.m.

7) Switch on the motor knob.

8) Switch off the cooling centrifuge.

Autoclave

(Do not autoclave liquids containing bleach, formalin or glutarldehyde.)

1) Check steam is ON.

2) Check that the jacket temperature has reached 121^0C.

3) Check cycle type.

4) Set cycle time or pre-set cycle.

5) Load autoclave correctly.

6) Close the autoclave door.

7) Start cycle.

8) Wait till the autoclave's temperature reaches 121^0C .

9) The autoclave is left unattended until the end of the cycle.

10) At completion of the cycle, Ensure that the pressure in the chamber is zero before opening the door.

11) Loose radial arms slowly.

12) Open the autoclave door.

13) Remove steam from the autoclave.

14) Use insulated gloves to remove goods.

Rota mantle

Objective: The Rotamantle is a combination of heating Mantle cum Magnetic Stirrer to obtain heating & in flat bottom round flasks, is used for the boiling, evaporation, distillation, or Extraction process

Procedure:

1) Switch on the mains of Rota Mantle.

2) Set the required temperature and rotations per minute setting.

3) Monitor the temperature and rotations per minute.

4) Do not turn the heating knob on the mantle without solvent in the bottom of a round bottom flask. Doing so will cause heating mantle break down

5) Do not remove the round bottom flask when RPM knob is on

6) Place a HOT warning sign near the heating mantle.

7) Monitor the system during heating and rotating procedure.

8) When the procedure is complete, carefully remove glassware, using heat proof gloves.

9)Switch off the heating mantle and leave the HOT warming sign in place until everything is cool.

WEIGHING BALANCE

Procedure:

o Place the balance on a level surface and make sure it is firmly secured.

o Place the object to be weighed on the left side of the balance.

o Adjust the sliding weights on the right side of the balance until the two sides of the balance are equal and the pointer is in the center.

o Record the weight of the object by reading the value of the sliding weights.

Precautions:

o Ensure that the balance is level on a flat surface before use.

o Check for any visible damage to the balance before use.

o Make sure that the balance is properly calibrated before use.

o Ensure that the pan is clean and free of any debris before use.

o Handle the balance gently to avoid any physical damage.

o Ensure that the balance is not exposed to extreme temperatures or humidity.

o Never overload the balance beyond its capacity.

o Avoid using the balance near any strong magnetic fields or electrical equipment.

o Make sure to use the balance in a dust-free environment.

o Clean the balance regularly with a soft cloth and appropriate cleaning solutions.

Uses And Maintenance:

o Calibration: The first step in maintaining a weighing balance is to ensure it is properly calibrated. This is done by ensuring that the balance is initially at zero and then by adjusting the weights to the balance to ensure that the balance functions correctly.

- Cleaning and Lubrication: Cleaning and lubricating the weighing balance is important to ensure accuracy and prevent wear and tear. This should be done regularly to clean and lubricate the parts of the balance. Checking Accuracy: To ensure accuracy of the balance, it is important to check the accuracy of the balance with a certified weight or by using a test weight. A certified weight should be used if the balance is used for commercial or regulated purposes.

- Temperature Compensation: Temperature fluctuations can cause inaccurate readings on a weighing balance. To avoid this, it is important to use temperature compensation to ensure accuracy.

- Storage: When not in use, the balance should be stored in a clean, dry environment away from direct sunlight or other sources of heat.

SINGLE BEAM VISIBLE SPECTROPHOTOMETER

- Check the material of the sample container is compatible with the wavelength to be used with the wavelengths to be used for measurements.
- Standard plastic cuvettes should be used ONCE only.
- Care should be taken when selecting semi-micro or micro cuvettes.
- A glass test tube and another sample tube should be used with care.
- Ensure any sample containers used are compatible with constituents of 'both sample and standards they are held.
- All sample containers must be handled with care.
- Flow-through cuvettes must be selected with care.
- Sample and standards should not be stored in open cuvettes or sample containers.
- All measurements required calibration to a blank for maximum accuracy.
- Prepare calibration curve for standard concentrations
- Cuvettes and sample holders must be filled to a minimum level that covers the light path.

UV SPECTROPHOTOMETER

- Switch on the power buttons which are on the back side of the instrument.
- Switch on the computer and UV instrument and wait for 10 minutes.
- Fill both sample cuvettes first with solvent and click on the icon "Auto zero" which is present on the toolbar. After some time the instrument will ask to keep cuvettes for 100% transmittance. Keep cuvettes in the UV instrument and press K for 100% transmittance.
- The current status will display on the bottom (left side) of the screen. First, it will show setting up then performing Auto zero then Idle. After finishing Auto zero-fill your sample with the required concentration in the cuvette (front one) and keep another cuvette reference (already filled with solvent).
- Click on the Start icon which is present on the toolbar, After some time the instrument asks to keep cuvettes for performing a sample with sample No, and press ok.
- Wait until the system becomes idle then go for the next step.After finishing the first sample, the instrument will ask for keeping the next sample then fill the next sample in the cuvette and press OK.

Department of Biotechnology

Laboratory Area

S.N	Laboratories and Rooms	Area (Sq.ft.)
1	Laboratory 1	570 Sq.ft.
2	Laboratory 2	570 Sq.ft.
3	Laboratory 3	600 Sq.ft.
4	Laboratory 4 (Chemistry)	300 Sq.ft.
5	Laboratory 5 (Research)	900 Sq.ft.
6	Department Staff Room	150 Sq.ft.

Sonopant Dandekar Shikshan Mandali's
Sonopant Dandekar Arts, V. S. Apte Commerce
& M. H. Mehta Science College, Palghar
(Best College - University of Mumbai)
(Amongst Top 100 Colleges in India by 'India Today - MDRA Survey 2019')

Department of Botany

STANDARD OPERATING PROCEDURE (SOP)
FOR
STUDENTS

- **This SOP is beneficial for students undertaking practical work in the department of Botany.**
- **A laboratory area displays the SOP for various instruments, which is an additional measure for the successful execution of practical**

In order to succeed the Botany practical, students must strictly follow the instructions:

1. Wear apron before entering the lab.
2. Students should cover eyes with goggle and also use shoes to protect feet and legs.
3. Students should be properly dressed so that entire body part must be covered.
4. Follow the instruction of the teacher's during the practical.
5. Do not perform any other practical without permission of teacher.
6. Always go through the MSDS (Material Safety Data Sheet) of chemicals prior to performing practical.
7. Do not touch or sniff any chemicals in the laboratory even though they may seems to be common in practice.
8. Be aware of all the emergency procedures.
9. Always wash the hands before and after completion of experiment.
10. In case of any miss-handling with plant material, fungal samples or chemicals or any accident/incident inform the teacher immediately.
11. Students should strictly follow the policies of the college.

Centrifuge

Ensure that the instrument is clean and free from dust

Ensure that all the knobs are in normal position

Open the upper lid by releasing the lock and lifting it up

Place the centrifuge tubes in the compartment provided for it

Switch “ON” the mains

Set the required time by using adjustment knob

Adjust the RPM of the machine with the help of adjustment knob

After completion of centrifugation time, a buzzer will beep, which indicates the completion of cycle

After a beep, a motor will automatically cut off and RPM come down to zero

Switch off the mains

Bacterial incubator

Switch on the main switch then the cabinet switch

↓

Set the require temperature by pressing the “Set knob” and “Soft keys”

↓

Monitor the temperature

↓

Control the temperature every day as by the following procedure

↓

Record the temperature which is displayed on the controller

↓

Monitor the temperature displayed on the digital screen. The temperature should not deviate by 2^0C

Colorimeter

Press the ON button on the Colorimeter to select the correct wavelength for your experiment (Ex: 430 nm, 470 nm, 565 nm, or 635 nm)

Allow the Colorimeter to warm up for about five minutes before calibrating

Choose the right filter

Select the appropriate mode, i.e. % transmittance or absorbance

Insert the test tube containing the "Empty" or "Reference" solution

Auto zero with blank solution

Remove the test tube containing the blank solution and introduce the sample solution

Note the reading

Laminar air flow

Ensure that the instrument is clean and free from dust

↓

Adjust the three pin plug and supply the power

↓

Switch on the mains

↓

Turn on the switch of UV light; leave the UV on for at least 30 minutes

↓

Turn OFF the UV light

↓

Turn ON the switch of visible light

↓

Turn ON the switch of Air Flow

↓

Proceed for the experiment

BOD incubator

Switch “ON” the instrument (if Instrument is off)

Set required temperature with the help of Coarse and finally with the help of fine adjustment

Digital display will show the desired temperature

Ensure that the door of the incubator is properly closed and does not loosen during operation

Ascertain and set the points at which calibration is required

Maintain Logbook of BOD Incubator

Hot air oven

Switch on the mains and the instrument and adjust the required temperature by using a thermostat.

Keep the samples in the space provided

Close the door of the apparatus by tightening the screws provided

Check the required temperature is reached by the thermometer provided inside og the oven

Switch off the instrument and open the door for removing samples

Close door after removing samples

Weighing balance

Switch on the mains

↓

Open the door from one side

↓

Keep butter paper or sampling bag

↓

Close the door and press tare (T) key

↓

Open the door and put required sample

↓

Add the sample till you get desired weight on display and closed the door

↓

Open the door and take out the sample

Muffle Furnace

Ensure that the instrument is connected to the power supply

↓

Switch ON the main power supply, glowing of red light at mains indicate the power supply

↓

Switch ON the instrument by ON position which leads to activation of green control bulb and temperature controller

↓

Set the temperature required by adjustment knob

↓

The digital display shows the actual temperature of furnace

↓

When the temperature reaches the setting point, the red light of the temperature controller automatically switched off and green light will glow

↓

The equipment is not ready for operation

Sonopant Dandekar Shikshan Mandali's
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DEPARTMENT OF BOTANY

STANDARD OPERATING PROCEDURE (SOP)

FOR CHEMICAL STORAGE

This SOP is very useful for safe chemical storage, which is necessary to prevent accidents in our store. This Standard Operating Procedure for Chemical Storage must be followed by all students, faculty and staff.

- General Rules: Chemical Storage
  Criteria for Storage Area :
  1. Store chemicals inside a closeable cabinet or on a sturdy shelf.
  2. Shelf should have a front-edge lip to prevent accidents and chemical spills (recommended 4-5 inch high).
  3. For example, flammable chemicals shall be stored in an appropriately rated flammable storage cabinet
  4. Corrosive chemicals should be stored in a corrosive storage cabinet when not in use.
  5. Keep all stored chemicals, especially flammable liquids, away from heat and direct sunlight
  6. Shelving should be secured to wall or floor.
  7. Ensure that all storage areas have doors with locks.
  8. Keep chemical storage areas off limits to all students.
  9. Ventilate storage areas adequately.
  10. Organize chemicals first by compatibility-not alphabetic succession. Store alphabetically within compatible groups.

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DEPARTMENT OF BOTANY

STANDARD OPERATING PROCEDURE (SOP)
FOR OPERATION OF COMPOUND MICROSCOPE

This SOP shall applicable for the operation of compound microscope in the Botany Laboratory to study anatomy

General Procedure and precautions

1. Microscope shall kept on vibration free platform
2. Surface of microscope shall be clean with a clean cotton cloth to remove dust.
3. Eyepiece, Objective lenses, magnifying lens, condenser shall be clean with cotton soaked in xylene
4. Power objective (10 X, 45 X etc.) shall be adjusted by rotating the revolving nose piece in position.
5. When using the oil immersion objective, power objective shall be swing partially out of way and place a drop of oil on the area of slide where observing and bring the oil-immersion objective into position.
6. Ensure for keeping the microscope and its part clean and handle all the parts with care.
7. Microscope shall covered always when not in use.

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Department of Botany

STANDARD OPERATING PROCEDURE (SOP)
FOR
COLLECTION AND STORAGE OF PLANT/BIOLOGICAL MATERIAL

- **This SOP is beneficial for students undertaking practical work in the department of Botany.**

In order to succeed the Botany practical, students must strictly follow the instructions:

1. Collect the sample from the field by using convenient tool
2. Take the sample in plain and black poly bags (in case if light sensitive material)
3. Keep this bag in air tight plastic container
4. Place the label in the air tight plastic container
5. While collecting the sample kindly fulfil following details
    a. Name of material : ----------
    b. Quantity :----------
    c. Date and time : ----------
    d. Storage condition : ----------
    e. Name of collector : ----------
    f. Sign : ----------
6. Store the sample in container as per the condition

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DEPARTMENT OF BOTANY

STANDARD OPERATING PROCEDURE (SOP) FOR DISPOSAL OF PLANT MATERIAL AND CHEMICALS

This SOP is very useful for safe chemical storage, which is necessary to prevent accidents in our store. This Standard Operating Procedure for Chemical Storage must be followed by all students, faculty, and staff.

General Rules of Disposal Plant material and Chemicals

1. Place specimens and any experimental plant extract in a sealable plastic bag or the bags in which they were shipped.
2. Seal the bag and place it in an additional plastic trash bags
3. Deposit the specimens in a securely covered trash container that will not allow children and animals to access the contents
4. Contaminated organic solvents such as acetone, alcohol, MEK should never be poured into the sink Contaminated organic solvents such as acetone, alcohol, MEK should never be poured into the sink, these solvents should be put into metal safety cans

5. Each solid chemicals are to be collected in polybag separately & tie its mouth. Hand over all such bags to ETP for further disposal For example, flammable chemicals shall be stored in an appropriately rated flammable storage cabinet

6. . Never mix two chemicals that are to be disposed they might form explosive otherwise harmful mixtures.

7. Always label all waste material

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SOPS FOR TRANSFERRING CHEMICALS

The following are some general standard operating procedures for transferring chemicals in a laboratory:

- Before beginning any transfer, review the Material Safety Data Sheet (MSDS) for the chemical(s) being transferred to understand any potential hazards and the appropriate handling procedures.
- Always wear appropriate personal protective equipment (PPE), such as lab coats, gloves, and eye protection, when handling chemicals.
- Identify the chemical(s) to be transferred and the appropriate container(s) to be used for the transfer.
- Label all containers with the chemical name, concentration, and any hazards associated with the chemical.
- Check the compatibility of the chemical(s) and the container(s) to be used for the transfer.
- Ensure that the area where the transfer is to take place is clean and free of any potential hazards.
- Use appropriate tools, such as funnels and pipettes, to transfer the chemical(s) from one container to another.
- Avoid overfilling containers and use appropriate handling techniques to prevent spills and splashes.
- Keep a spill kit and fire extinguisher nearby in case of accidental spills or fires.
- Dispose of any waste chemicals and contaminated materials according to established protocols.

- If transferring a volatile or highly reactive chemical, use a fume hood to contain any potential fumes or reactions.
- Avoid transferring chemicals near open flames or other sources of ignition.
- When transferring liquids, pour slowly and carefully to avoid splashes or spills.
- When transferring solids, use appropriate tools to prevent dust and minimize the risk of exposure.
- Always handle toxic or hazardous chemicals in a designated area, such as a chemical fume hood or an isolation chamber.
- When transferring chemicals to a new container, ensure that the container is properly labelled with the chemical name, concentration, and any hazards associated with the chemical.
- Keep a record of all chemical transfers, including the date, chemical name, quantity, and any hazards associated with the chemical.

  After transferring chemicals, clean up any spills or residue and dispose of any contaminated materials according to established protocols.
- It's important to note that specific procedures for transferring chemicals may vary depending on the type of chemical and the laboratory's specific protocols. Always consult your laboratory's safety guidelines and procedures before handling any chemicals.
- Remember, safety is always the top priority when working with chemicals in a laboratory. Follow established procedures and guidelines, wear appropriate PPE, and always exercise caution and good judgment to minimize the risk of accidents or injuries.

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DEPARTMENT OF CHEMISTRY

Standard operating procedure (SOP)

For Gas cylinder and Compressed gas

This SOP is very helpful for the safe handling of compressed gas and gas cylinders, which is necessary to prevent mishaps in our laboratory. All students and teaching and non-teaching staff must follow this compressed gas and gas cylinder SOP.

1. Process (if applicable): Gas cylinders (inert)

2. Chemicals: Compressed gas cylinders present hazards because of the volume of gas and the pressures involved. Leaking or vented inert gas can displace breathing air. This SOP is for N2, Ar, Air, CO2, SF6.

3. Personal Protective Equipment (PPE): Wear goggles. Gloves, face shields, lab coat or apron, and/or gas mask may be required for personal protection depending on the gas and use.

4. Environmental /Ventilation Controls: Fittings and connections must be properly tested for leaks using soapy water, 'Snoop', or another appropriate test system or meter. Do not use an open flame.

5. Special Handling Procedures & Storage Requirements:

1. All cylinders should be properly identified and the specific hazards of each cylinder should be known.
2. Cylinders must be fastened securely at all times whether in use, transit, or storage.
3. Cylinder safety caps must be in place whenever cylinders are not in use for an extended period of time or during transport.
4. Proper valves or regulators for the specific gas must be used.
5. Store and use cylinders in ventilated areas away from heat or ignition sources.
6. When not in use, separate flammables and oxidizers. Transport large cylinders only on an approved cart.

6. Spill and Accident Procedures: If safe, turn the gas valve off. For cylinders that continue to leak, immediately take necessary action and information to the Lab supervisor.

7. Waste Disposal: Empty nontoxic or non-corrosive gas cylinders should be marked 'empty' and returned to the supplier. Empty gas cylinders that contained toxic or corrosive gases must be stored in a fume hood or well-ventilated space for pickup by the supplier.

8. Groups of compressed gases: There are three major groups of compressed gases stored in cylinders.

- ✓ Liquefied
- ✓ Non-liquefied
- ✓ Dissolved gases

Note that a compressed gas cylinder with a pressure gauge reading of 0 kPa or 0 psig is not really empty. It still contains gas at atmospheric pressure and therefore must be treated with the same safety precautions as a full cylinder.

Liquefied Gases

Liquefied gases are gases that can become liquids at normal temperatures when they are inside cylinders under pressure. They exist inside the cylinder in a liquid-vapor balance or equilibrium. Initially, the cylinder is almost full of liquid, and gas fills the space above the liquid. As gas is removed from the cylinder, enough liquid evaporates to replace it, keeping the pressure in the cylinder constant. Anhydrous ammonia, chlorine, propane, nitrous oxide, and carbon dioxide are examples of liquefied gases.

Non-Liquefied Gases

Non-liquefied gases are also known as compressed, pressurized, or permanent gases. These gases do not become liquid when they are compressed at normal temperatures, even at very high pressures. Common examples of these are oxygen, nitrogen, helium and argon.

Dissolved Gases

Acetylene is the only common dissolved gas. Acetylene is chemically very unstable. Even at atmospheric pressure, acetylene gas can explode. Nevertheless, acetylene is routinely stored and used safely in cylinders at high pressures (up to 250 psig at 21°C). When acetylene gas is added to the cylinder, the gas dissolves in the acetone. Acetylene in solution is stable.

Compressed gases may also be flammable, pyrophoric, toxic, oxidizing, asphyxiating and/or corrosive. Compressed gases are potentially hazardous since they are under great pressure in a container and can also create health hazardous and/or flammable atmospheres.

9. Physical Hazards:

- Accidental rupture or valve damage of the cylinder and the rapid release of the pressurized gas can result in injury to persons and damage to objects in the vicinity.
- The rapid release of gas from a ruptured or valve-damaged cylinder may propel the cylinder for a long distance, making them a potential rocket or bomb.
- A gas cylinder falling over can break containers and crush feet.
- Containers may explode when heated.
- Some gases (e.g. silane, diborane, phosphine) are considered pyrophoric and will ignite spontaneously in air.
- Leak of flammable or reactive gases can result in fire and exploding cylinders
- Vapors from liquefied gas are initially heavier than air and spread along the ground.

10. Health Hazards:

- A leak of inert gases (e.g., nitrogen, CO2) can quickly displace air in a large area creating an oxygen-deficient atmosphere (an asphyxiation hazard) if released in an inadequately ventilated room.
- A leak of toxic gases can create poisonous atmospheres.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire may produce irritating, corrosive and/or toxic gas by-products.
- See the Safety Data Sheet (SDS) for chemical-specific hazard information.

11. General Control of Hazards:

- Conduct a hazard assessment to identify proper use and handling techniques, fire safety, storage, and waste disposal issues specific to the chemical being used.
- Never use or move a compressed gas cylinder unless you have been provided with hands-on training on how to use and move a cylinder safely.
- Order gas cylinders with a restrictive flow orifice to limit the gas flow rate leaving the cylinder.
- Order with pressure relief device to allow safe venting if excessive pressure develops.
- Inspect the gas cylinder and regulator prior to use. Never use gas cylinders or regulators that are damaged or corroded.
- For flammable gases, use non-sparking, non-ferrous tools for installing regulators and tightening other connections.
- Check connections and hoses regularly for leaks using a gas-specific monitoring instrument or soapy water (or equivalent).
- When using highly flammable or toxic gas, check the delivery system for leaks using an inert gas prior to introducing the hazardous gas.
- Open flammable gases a maximum of 1.5 turns (so it's easier to close the valve quickly if needed).
- Replace valve caps when cylinders are not in use or before moving.
- All compressed gases must be clearly labelled with the correct chemical name.

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DEPARTMENT OF CHEMISTRY

STANDARD OPERATING PROCEDURE (SOP)

FOR

Basic Safety Measures

This SOP is help full for students while coming for practical in the department of chemistry laboratory. SOP of various basic safety measures are available at the site, this SOP is additional for smooth conduct of practical.

A. General Safety Rules :

- Listen to or read instructions carefully before attempting to do anything.
- Wear safety goggles to protect your eyes from chemicals, heated materials, or things that might be able to shatter.
- Notify your teacher if any accidents occur.
- After handling chemicals, always wash your hands with soap and water.
- During lab work, keep your hands away from your face.
- Tie back long hair.
- Know the location of the fire extinguisher, fire blanket, eyewash station, and first aid kit.
- Keep your work area uncluttered. Take to the lab station only what is necessary.
- Never put anything into your mouth during a lab experiment.
- Clean up your lab area after finishing of lab work.
- Never "horse around" or play practical jokes in the laboratory.

B. Glassware Safety:

- Become familiar with the hazards of the apparatus and the operations involved.
- Check the condition of glassware before and after using it.
- Inform your teacher about any broken, chipped, or cracked glassware; it should not be used.
- Do not pick up broken glass with your bare hands.
- Never force glass tubing into rubber stoppers
- Never place glassware near edges of your work surface.
- Never eat or drink out of lab glassware
- Hot glass does not look hot. Don't pick up any glassware that may have been heated without checking to see if it is hot first.

C. Chemical Safety :

- Wear protective goggles whenever heating or pouring hazardous chemicals.
- Never mix chemicals together unless you are told to do so.
- Never taste any chemicals.
- If you need to smell the odor of a chemical, waft the fumes toward your nose with one hand. Do not put your nose over the container and inhale the fumes.
- Follow the instructions of your teacher when disposing of all chemicals.
- Wash your hands after handling hazardous chemicals.
- Dispose of all chemicals as instructed by teacher. To avoid contamination do not return chemicals to their original containers
- Be careful when working with chemicals such as acids or bases. Always pour them over the sink rather than over your work area
- When diluting an acid always add small amounts of Acid to Water.
- Rinse acids or bases off of skin immediately. Notify teacher immediately of spills.
- Never taste any chemicals before undertaking any work become familiar with the hazards of the chemicals involved.

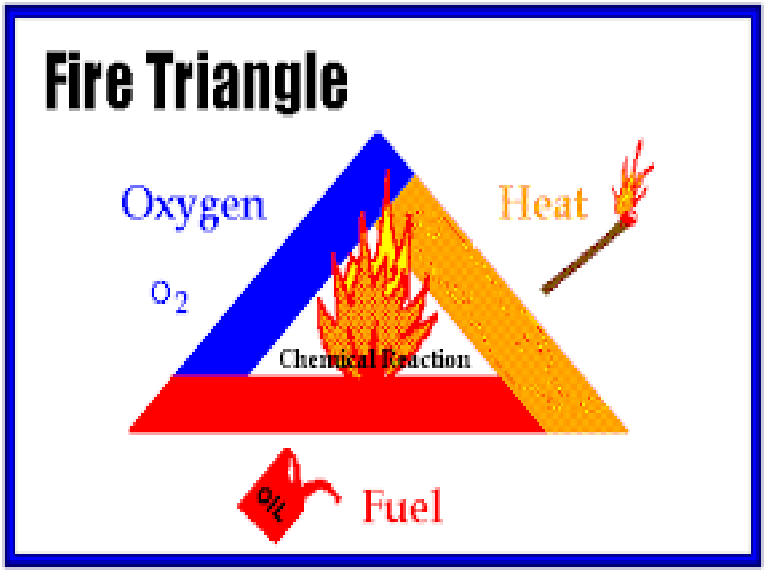
D. Electrical Safety :

- Lay electrical cords where no one can trip on them or get caught in them.
- Be sure your hands and your lab area are dry before using electrical equipment.
- Never poke anything into electrical outlets.
- Unplug cords by pulling the plug and NOT the cord.
- Turn off and unplug all electrical equipment as soon as you are finished using the equipment.

E. Heating Safety :

- Let hotplates and microscopes cool down before touching them. Test to see if they are cool enough by bringing the back of your hand close to them.
- Use tongs to handle hot objects.
- The only type of glassware that may safely be heated is either Kimax or Pyrex.
- Always point the top ends of test tubes that are being heated away from people.
- Only glassware that is thoroughly dry should be heated. 6. Never leave a hotplate unattended.

F. Fire Safety :



Fire Safety, at its most basic, is based upon the principle of keeping fuel sources and ignition sources separate.

BusinessWatch

TYPE (Extinguisher Type)	Class A — Organic Materials (e.g. Paper & Coal)	Class B — Flammable Liquids (e.g. Petrol & Paint)	Class C — Flammable Gases (e.g. Butane & Mathane)	Class D — Flammable Metals (e.g. Lithium & Magnesium))	Class E — Electrical Equipment (e.g. Computers & Servers)	Class F — Cooking Oils (e.g. Olive Oil & Fat)	Businesses that may need this types of extinguisher
Water	✓	✗	✗	✗	✗	✗	*Schools Hospitals Offices Shops*
Foam	✓	✓	✗	✗	✗	✗	*Apartments Hospitals Offices Shops*
Dry Powder	✓	✓	✓	✓	✓	✗	*Garages Welding Boiler Rooms LPG Plants*
CO2	✗	✓	✗	✗	✓	✗	*Server Rooms Offices*
Wet Chemical	✓	✗	✗	✗	✗	✓	*Kitchens Canteens*

DEPARTMENT OF CHEMISTRY
STANDARD OPERATING PROCEDURE (SOP)
FOR
CORROSIVE CHEMICALS

Corrosive Description :

A material is corrosive if it either can cause irreversible destruction of living tissue or materially damage/ destroy metals through chemical action at the point of contact. Corrosive chemicals can be liquids, solids, or gases. Liquid corrosive chemicals are those with a pH of 4.0 or lower or a pH of 9 or higher. Solid chemicals are considered corrosive are those with a pH of 4.0 or lower or a pH of 9 or higher when in solution. A highly corrosive chemical has a pH of 2 or lower or a pH of 12.5 or higher. Corrosive chemicals are mainly acids and bases. Corrosives can also be oxidizing, flammable, dehydrating, self-heating, water reactive or toxic.

Physical Hazards :

- Will materially damage, or even destroy, metals.
- Contact with metals (e.g. Aluminum) may evolve flammable hydrogen gas.

Health Hazards :

- Serious eye damage is the production of tissue damage in the eye, or serious physical decay of vision.
- Irreversible tissue damage at site of contact may also include respiratory tract.
- Vapors may be irritating and may cause burns.
- Skin corrosion is the production of irreversible damage to the skin; namely, visible necrosis through the epidermis and into the dermis.

Control of Hazards – General

Conduct a hazard assessment to identify proper use and handling techniques, fire safety, storage, and waste disposal issues specific to the chemical being used.

- Do not add water to the corrosives. Add corrosives to water, slowly, in small amounts, with frequent stirring. Do not pour water into acid. Slowly add the acid to the water and stir.
- Open bottles or carboys slowly and carefully and wear protective equipment to guard hands, face, and body from splashes, vapors, gases and fumes.

- Plan work to avoid contact with gloves. Change gloves immediately if contaminated.
- Use designated areas when working with highly hazardous corrosives such
- as hydrofluoric acid, perchloric acid, picric acid, aqua regia, or piranha solution. Informed lab members prior to work. Label the area with appropriate signs.

Personal Protective Equipment:

In addition to proper street clothing (long pants or equivalent that cover legs and ankles, close-toed nonperforated shoes that completely cover the feet), wear the following Personal Protective Equipment (PPE) when performing lab operations/tasks:

- Safety glasses (If splash potential exists, use goggles + face shield instead)
- Lab coat.
- Appropriate chemical-resistant gloves.

Waste Disposal :

- Corrosive chemicals are hazardous wastes. Waste streams that include a mixture of corrosive liquids and peroxides (such as Piranha etch, Chromerge, and Nochromex) produce gas and require special waste procedures.
- Bleach solution greater than 10% is considered hazardous waste and must be collected to be disposed by OEHS.

Department of Chemistry

First Aid -

Skin Exposure:

- Wash affected area(s) with water from an emergency safety shower. Take care not to break skin.
- Remove or cut off contaminated clothing while rinsing. Do not pull contaminated clothing over the head.
- For chemical and thermal burns, flush affected area(s) with water from the safety shower, if indicated in safety data sheet.
- For blood, biological, or radiological, chemical exposures use soap and water.
- Keep flushing affected area(s) underneath the safety shower until emergency personnel arrive.
- Seek medical attention.

Chemical Inhalation:

- If exposed individual is conscious, move the person to fresh, uncontaminated air.
- Seek medical attention.

Chemicals in the eyes:

- Stand the affected person in front of and leaning over the sink.
- Pull the eye wash fountain out of its receptacle.
- With the fountainhead face up, gently squeeze the handle towards the hosting to create a flow of water.
- Position the fountain so that the flow of water gently flushes the eye. The required time for flushing eyes depending on the nature of the irritant.
- Release the pressure on the fountain to stop the flow of water. Holding the fountain head allow the eye wash fountain to retract into its receptacle.
- Seek medical attention.

Chemical Ingestion:

- If safe to do so, move affected individual to an uncontaminated area.

- Do not induce vomiting or drink water or other liquids unless instructed to do so by emergency personnel.
- Seek medical attention.

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DEPARTMENT OF CHEMISTRY

STANDARD OPERATING PROCEDURE (SOP)
FOR
FLAMMABLE CHEMICALS

This SOP is very help full for flammable chemicals which is important to disposal of flammable chemicals, solvents and reagents as Well as prepared products during practical's safely without any type of hazard to environment and human beings . All students and teaching and non-teaching staff have to follow this SOP.

Flammable chemicals are easily ignited and are capable of burning rapidly. The following flammability hazards are included in this SOP:

- Flammable gas
- Flammable aerosol
- Flammable liquid
- Flammable solid
- Combustible liquid

- A flammable liquid is a liquid having a flash point of not more than 199.4 °F (93 °C).
- **PHYSICAL HAZARDS**
    - HIGHLY FLAMMABLE: Will be easily ignited by heat, sparks or flames.

- Vapors may form explosive mixtures with air and may explode if ignited in an enclosed area.
- Flashback along vapor trail may occur.

- **HEALTH HAZARDS**
  - Inhalation or contact with material may cause irritation and/or skin and eye damage.
  - Fire may produce irritating, corrosive and/or toxic gases.
  - Vapors may cause dizziness and suffocation.
  - May cause toxic effects if inhaled, ingested or absorbed through skin (e.g. kidney or liver damage; carcinogen).
- Refer to chemical specific SDS for specific hazard information.

- **GENERAL CONTROL OF HAZAEDS**

The following general control measures should be implemented whenever using or handling flammable chemicals:

- Keep away from heat, sparks, open flames and hot surfaces.
- Never heat flammable chemicals with an open flame. If the temperature must be increased, use an oil or water bath.
- Avoid using ignition sources (e.g. Bunsen burners, hot plates, oil baths, electrical equipment with frayed or cracked wiring, etc.) in areas where highly flammable (i.e. low flash point) chemicals are used.
- Avoid creating static electricity in areas where highly flammable chemicals are used.
- Do not pierce or burn pressurized containers of flammable aerosols, even after use.

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DEPARTMENT OF CHEMISTRY

STANDARD OPERATING PROCEDURE (SOP)
FOR CHEMICAL DISPOSAL

This SOP is very help full for chemical disposal which is important to disposal of chemicals, solvents and reagents as Well as prepared products during practicals safely without any type of hazard to environment and human beings . All students and teaching and non-teaching staff have to follow this SOP .

Disposal of Chemicals

- Organic Solvents

  1. Contaminated organic solvents such as acetone, alcohol, MEK should never be poured into the sink.
  2. These solvents should be put into metal safety cans.
  3. If you plan to use a large quantity of organic solvents, you should buy a safety can for your lab.
  4. However, these are for use only by people using the specific areas which they serve.
  5. Every time you add a compound to the safety cans, you must do the following.
  6. List the compound name and quantity each time. Estimate quantity in millimeters.
  (We suggest transferring the waste in a graduated beaker)
  7. For mixtures, estimate the component quantities, eg. 750 ml of 50:50 methanolz- butanol would be written 375 methanol/375 mg., t-butanol/375 ml. 8. Use the back of the tag if more entries are made than there is space provided.

  DO NOT PUT ACIDS IN SOLVENT WASTE CANS. THIS INCLUDES ELECTROPOLISHING ELECTROLYTES AND ETCHANTS.

- Non-Organic Waste

  To dispose of non-organic wastes:

1. Place in 'Primary' container (or original glass container).
2. Label this with the amount and identity of the contents. 2. Place all primary containers in á secondary (cardboard box) filled with packing material.
3. Label this box with the contents of primary containers, your room number and the building number.
4. This procedure is to be followed for all inorganic waste including acids and toxic substances.
5. Always label all waste material.
6. Never mix two chemicals that are to be disposed they might form explosive otherwise harmful mixtures.

Type	Procedure for Disposal
Liquid Chemicals	To be drained carefully with continuous flow of water into sink.
Solid Chemicals	Each solid chemicals are to be collected in polybag separately & tie it's mouth. Hand over all such bags to ETP for further disposal.
Cyanide and Cyanide and Toxic/Poisonous chemicals	All such type of waste generate contamination waste at Q.C. Lab to be treated ensure Other it free from cyanide
Hazardousand chemicals (As per packed in bag and then it is to SOP)	All such type of waste to be be handed over to ETP for further action

Disposal Procedures:
1. Sorted by compatibility
2. In approved containers
3. Tighten caps
4. Ensure contents are properly identified
5. Move to a Satellite Accumulation Area
6. Call HWC to Pickup Number
7. Complete Forms or ensure labeling information
8. Varies from Location to Location
9. Drop off at Marshalling facility or arrange for pick up
10. Waste Disposal Company will lab pack

11. Dispose off the materials as per the category mentioned in above table
12. Dispose off the materials in presence of supervisor and safety officer only
13. Use hand gloves, safety goggles, mask and other required protective means.
14. Maintain the duly signed and verified record.

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DEPARTMENT OF CHEMISTRY

STANDARD OPERATING PROCEDURE (SOP)

FOR CHEMICAL STORAGE

This SOP is very help full for safe chemical storage which is important to keep our store free from accident . All students and teaching and non-teaching staff have to follow this SOP for chemical storage.

- General Rules: Chemical Storage
  Criteria for Storage Area :
  1. Store chemicals inside a closeable cabinet or on a sturdy shelf.
  2. Shelf should have a front-edge lip to prevent accidents and chemical spills (recommended 4-inch high).
  3. Shelving should be secured to wall or floor.
  4. Ensure that all storage areas have doors with locks.
  5. Keep chemical storage areas off limits to all students.
  6. Ventilate storage areas adequately.

- Organization:
  Organize chemicals first by COMPATIBILITY-not alphabetic succession. Store alphabetically within compatible groups.

- Chemical Segregation
  1. Store acids in a dedicated acid cabinet.
  2. Nitric acid should be stored alone unless cabinet provides a separate compartment for nit acid storage.
  3. Store highly toxic chemicals in a dedicated, lockable poison cabinet that has been labeled with highly visible sign.

- Chemical Segregation:
  1. Store volatile and odoriferous chemicals in a ventilated cabinet.
  2. Store flammables in an approved flammable liquid storage cabinet.
  3. Store water sensitive chemicals in a water-tight cabinet in a cool and

dry location
segregated from all other chemicals in the laboratory.

- Storage Don'ts:
  1.Do not place heavy materials, liquid chemicals, and large containers on high shelves.
  2. Do not store chemicals on tops of cabinets.
  3. Do not store chemicals on the floor, even temporarily.
  4. Do not store items on bench tops, in laboratory chemical hoods or under
  sinks.
  5. Do not store chemicals on shelves above eye level.
  6. Do not store chemicals with food and drink.
  7. Do not store chemicals in personal staff refrigerators, even temporarily.
  8. Do not expose stored chemicals to direct heat or sunlight, or highly variable temperatures.
- Proper Use of Chemical Storage Containers:
  1.Never use food containers for chemical storage. Make sure all containers are properly closed.
  2. After each use, carefully wipe down the outside of the container with a paper towel before returning it to the storage area.
  3. Properly dispose of the paper towel after use.

- PROCEDURE:
  1. Label all reagents/chemicals received with date of receipt and exp. date.
  2. Mention shelf life of all reagents/chemicals for 5 years for sealed condition of container.
  3. At the time of opening of bottle label all reagents/chemicals with the date of opening & use before.
  4. Mention shelf life of all reagents/chemicals for 2 years from the date of opening the container
  5. Record the above dates on a separate label affixed on the container in such a way that it does not obscure the manufacturer's labe
  6. Store the reagents & chemicals at appropriate temperature & condition indicated on the container.
  7 .Destroy the reagents/chemicals after expiry date as per SOP.
  8. Store poisonous chemicals separately taking all safety precaution as per their Material Safety Data

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Standard Operating Procedures

Weighing Balance

Aim: Handling of weighing Balance.

Requirements: Analytical balance digital, transfer utensils (spatula)

Procedure:

1. Make sure that the balance is kept clean.
2. Ensure that the calibration status is valid.
3. Connect the power cable to the mains and switch ON.
4. Automatically self-checking starts from 'che-3' and ends with off.
5. Press ON/OFF key, all the display will glow.
6. Press TARE KEY, 0.000 mark appears on the display.
7. Once the stability is attained, the balance is ready for weighing.
8. Place the material to be weighed on the pan and note down the reading.
9. After completion of weighing press, ON/OFF key. STAND by light glows.
10. Clean the balance immediately after weighing.

Potentiometer

Instruction for proper handling of Potentiometer.

1) **Standardization:**
To Standardized the potentiometer,

1.Switch the instruments on about 10-15 minutes before starting the experiments.

2**.** Using the specially supplied connector cables, connect negative and positive input terminals with the corresponding negative and positive Standard cell terminals of a good Weston standard cell.

3. Observe the digital display. It should read 1.018volts, indicating that the instruments is already standardized, if not slowly standardise knob so that the display read 1.018 volts.

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Measurement of Potential:

1. To measure the e.m.f of the cell, connect the negative and the positive terminals of the cell to the corresponding input terminal seen on the potentiometer panel.
2. Observe the digital display. The reading gives potential of the cell connected to the potentiometer.
3. The reading must always be positive. If it is negative, reverse the connections of the terminal of the cell.

Conductometer meter

Standard operating procedure for Conductometer meter.

Conductivity meter is used to measure conductance.

A) Standardization:

To standardized the Conductometer,

1. Switch the instruments on about 10-15 minutes before starting the experiments.
2. Keep the Range switch on 2 (milli mho) position.
3. Keep the standard conductance switch at down position.
4. Observe the digital display. If the display shows 1.000, then it means the instruments is standardized, If not rotate the standardized shaft so that the display reads 1.000.

B) Accurate Method:

1. Switch the instruments on about 10-15 minutes before starting the experiments.

2.Keep the conductivity cell in distilled water for about 10-15 minutes, connect its terminals seen on the conductivity meter.

3.Prepare exact 0.1 N KCl solution. Take it in 100cm^3 beaker.

4. Remove the conductivity cell from distilled water. Wipe it clean softly with a filter paper and immerse it into 0.1N KCl solution.

5. Wait for about one minute, check the standard conductance switch. It should be keep on up position.

6. Select the correct range by rotating the range selector knob so as to get maximum number of significant figures on the display.

7. Observe the display, It should read specific conductance of 0.1 N KCl at 25^0C is 0.01288 mhos

8. If it does, then the instrument is already standardized, else rotate the standardize till the correct specific conductance is obtained.

(II) Measurement of conductance:

(1) Switch the instrument on about 10-15 minutes before starting the experiment.
(2) Keep the conductivity cell dipped in distilled water for about 10-15 minutes. Connect its terminals to the *cell* terminals seen on the conductivity meter.
(3) Confirm that the instrument has been properly *standardised*.
(4) Take the sample solution whose conductance is to be measured, in a 100 mL beaker.
(5) Remove the conductivity cell from distilled water. Wipe it clean gently with a filter paper and dip it into the sample solution.
(6) Wait for a *minute*. Check that the standard conductance switch is kept at up position .
(7) Rotate slowly the range selector knob till the display shows maximum number of significant figures.
(8) Note down the reading shown in the display with an exponent of (-3), e.g., if the display reads (3.142), note it as (3.142×10^{-3}) mhos. This is the conductance of the sample solution.

pH meter

Standard operating procedure for pH meter

Depending on the pH meter used and the electrode used procedure can look slightly different, but in most cases pH measurements procedure will be at least very similar.

First of all - remember, that **the electrode should not be dry, so immersed in proper solution**. Thus, between pH measurements it should be put into a beaker with distilled water or - much better - KCl solution (0.1M to 1M). Don't worry that you will destroy the electrode moving it between solutions. It can easily survive minute in the air, but don't let it dry.

Second, equally important thing is - **the electrode is very fragile**. Bubble at the end is made of very thin and delicate glass - the thinner glass improves the sensitivity. Thus, you should treat your electrode with care.

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Ensure that pH meter is on. If you want high precision of measurements, it is better to let the pH meter to warm up for some time (like 15 minutes) to ensure it will not drift later.

Before the use of pH measurement, you must calibrate pH electrode **by using pH buffer solution of pH 4.0, pH 7.0, pH 9.20.**

After calibration you are ready to measure pH. Rinse electrode and submerge it in the tested solution. Read the result and write it down in your lab notebook. Rinse the electrode and move it to the storage beaker.

NOTE: For any difficulties contact the experts.

Spectrophotometer/ Colorimeter.

Experiment No :2

Aim: Standardization of Spectrophotometer/ Colorimeter.

Instruction for proper handling of the Colorimeter:

I)Zero adjustment:

1) Switch the instruments on about 10-15 minutes before

starting the experiments.

2) Insert the required filter from the nonfilter end into the filter port.

3) Fill the sample carrier (cuvette) with the blank solution. Wipe it clean for outside. Place the port into the sample port. Push off-on switch to on position.

4)Put the % transmittance- Optical density (%T-O.D) switch on % Transmittance position.

5)Rotate the zero-adjustment knob so that the digital display shows zero.

6)Remove the cuvette containing blank from the sample port and again place it back taking care that the printed mark on the cuvette comes to the same position.

7) Check the reading on digital display. It should once again show zero, then repeat the step no.3 and 4 until display read zero.

II) 100% adjustment:

1) Push the off-on switch to off position.

2) Remove the filter from the filter port and re-insert it from the filter side. Or if no filter is kept inside, choose the required filter and insert it into the filter port from the filter side.
3) Fill the cuvette with the blank solution and wipe it clean from outside. Place this cuvette into the sample port. Push the off-on switch to on position.
4) Place the % transmittance- Optical density (%T-O.D) switch on % Transmittance position. Rotate the 100% Coarse knob slowly so that the display show about 97-98%. Rotate the 100% Coarse knob slowly, so that the display shows exact 100%.
5) Now rotate the 100% fine knob slowly so that the display shows exact 100%.
6) Remove the cuvette containing blank from the sample port and replace it back taking care to see that the printed mark on cuvette always comes to the same position.
7) Check the reading on the display. It should show 100% . If it does not show the100%,then repeat the step no 4, 5, 6 until the display reads 100%.

III)Measurement of the Absorbance:

1) Let the off-on switch be kept at on position. Check that filter kept inside the filter port is the required filter**.**
2) Rinse and fill the cuvette with the sample solution whose absorbance is to be determined. Wipe it clean from outside.
3) Check that the %T- O.D switch is kept on position and the printed mark on cuvette has been kept at the same position.
4) Read the display and note down reading. This is the absorbance of sample solution.

Some important precautions:

1) Wipe the cuvette clean before putting it inside the sample port.
2) Always check that the mark on the cuvette is kept at the same position with respect to the sample port.
3) Switch the instruments on about 10-15 minutes before

starting the experiments and do not switch of unless the experiment over or filter need to be changed.

4) After the filter or the sample solution is changed, wait for about 20-30 second before note down the reading from the display.

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STANDARD OPERATING PROCEDURE FOR GAS CHROMATOGRAPHY

1 Purpose

To describe procedure for operation of Gas Chromatography with auto injector' located in instrument lab of Analytical Development laboratory.

2 Procedure

2.1 Instrument startup

2.1.1 Connect the described column between the injector and FID in oven chamber.

2.1.2 Open the Nitrogen, Air and Hydrogen gas cylinder 1/3 by cylinder key. Keep pressure on cylinder regulator, Nitrogen- 5 kg/cm^2, Air- 4 kg/cm^2 and Hydrogen- 4 kg/cm^2.

2.1.3 Close down the door.

2.1.4 Put the main switch ON.

2.2 Software & Instrument operation

2.2.1 Press ON the PC and commutate the OpenLAB software with the instrument by double clicks on desktop, OpenLAB software will started by giving Login ID and password.

Login : admin

Password : password will be provided by responsible person.

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2.2.2 After giving login and password, software will start initialization automatically.

2.2.3 Use the Instruments pane(or Icon) in the Control Panel to setup and control the instruments connected to system.

2.2.4 From the navigation pane, select instrument. In the tree, locate and select the location where you want to add the instrument.

2.2.5 From the Instruments and Locations toolbar, select Create > Create Instrument.

2.2.6 In the Name box, type a name for the instrument. In the Description box, type a description of the instrument.

2.2.7 Select Save. The instrument is displayed in the navigation pane.

2.2.8 From the navigation pane, select Projects and the project group where you want to add a project.

2.2.9 From the Projects and Groups toolbar, select Create > Create Project.

2.2.10 In the Name box, type a name for the project.

2.2.11 In the Project folder path box, type the path of the folder, or select Browse and navigate to and select the folder. In the Description box, type a description of the project.

2.2.12 Select OK.

2.2.13 Select the project and launch.

2.2.14 From the main menu, select > File > Method to start a new method with the system default method parameters.

2.2.15 In the Instrument Setup dialog box, each tab in the dialog box corresponds to one of the configured modules of instrument. Select each tab to set up the parameters for that module.

2.2.16 Click on the ALS, set up the parameters for injection volume, washes and pumps of the sample as well as solvent.

2.2.17 Click on the Inlet, then click on SSL Front or SSL Back, select Heater, Pressure, Total Flow, purge flow, Split ratio & Gas saver. Put the value as per requirement, finally check the pressure which is should be between 30 to 40.

2.2.18 Click on the Oven box, keep the oven temperature and time program in the table as per requirement.

2.2.19

2.2.20 Column: select the columns which is attached in the oven, keep control mode on, set the flow of the column and mode of the flow (constant flow).

2.2.21 Detector: Click on FID front or FID back and keep the below parameters as per requirement. Keep the heater on- 300°C, H2 flow on -30 ml/min, Air flow on -400 ml/min and make up flow on 25 ml/min. Keep the Flame on.

2.2.22 Click on Signal, select Front or Back signal, save should be on and keep data rate/min peak width 50 Hz/0.004 min.

2.2.23 Click on Readiness, all parameters should be on.

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2.2.24 Once you have completed the instrument setup information , save the method, give the name of the method. Then go to control and download the method file.

2.2.25 After instrument ready for the injection, In the toolbar select the Single Run button, or in the menu select Control > Single Run.

2.2.26 In the Single Run dialog box, complete the fields i.e. Sample ID, method file, Data file name, Data path, etc.,

2.2.27 When you have completed the Single Run dialog box, click Start to begin the acquisition.

2.2.28 The current data will appear in the chromatogram window as it is acquired and stored on disk. At the end of the run, the chromatogram will be analyzed according to the method parameters, and a report generated if specified. If the sample is not analyzed at the end of the acquisition, click the Analyze button if you wish to view the results.

2.2.29 From the File menu, Click File > New > sequence, to a Sequence.

2.2.30 Complete the wizard to define your sequence. The wizard will step you through various parameter screens required to create an acquisition or reprocessing sequence depending on your choices and the instrument configured. When you have completed the wizard, click Finish.

2.2.31 To save the sequence, from the menu, click File > Save As... > Sequence. Browse to the location where you want to save your sequence, enter the name of the sequence, and then click Save.

2.2.32 Click the Sequence Run button, or from the Control menu, click Sequence Run....

2.2.33 In the Sequence Run dialog box, complete the fields, i.e. Sequence name, data file path, etc. Click Start to initiate the sequence acquisition. The current data will appear in the chromatogram window as it is acquired and stored on disk. At the end of the run, the chromatogram will be analyzed according to the method parameters, and a report generated if specified. If the sample is not analyzed at the end of the acquisition, click the Analyze button if you wish to view the results.

2.2.34 For the Data processing, go to main window Agilent OpenLAB Control Panel, select project and click on Launch Offline.

2.2.35 Select File > Open > Data.

2.2.36 The Open Data File dialog box opens to the result folder in your project files, and the Files of type to .dat.

2.2.37 The dialog box appearance and behavior will vary depending on your storage type. Select the data file and select Open.

2.2.38 In the top toolbar, select the Analyze button. This will integrate the chromatogram and display the baselines.

2.2.39 In the top toolbar, select the Integration Events button, to open the Integration Timed Events table. The Integration Off timed event has been added to the table.

2.2.40 To remove the event from your method, select the Integration Off row number and select the Delete key on your keyboard. You can also delete the event using the Edit > Cut command, and re-insert the event using the Edit > Paste command.

2.2.41 To temporarily view the effect of removing an event without actually removing it from the table, click the check box adjacent to the event to de-select it. To re-select the event, click the check box once again.

2.2.42 When you are finished with the Integration Events table, close it and return to chromatogram.

2.2.43 Report Template, after integrate the chromatogram click on File > Open > Standard Report.

2.2.44 Open the report template from the list and print the report, File > Print > standard report and select the report template.

Standard Preventive maintenance schedule

Sr. No	Frequency	Task
1	Daily	1. Check and clean syringe with solvent. 2. Change washing solvents regularly. 3. Check pressure of gas cylinders. Replace the cylinder when its pressure drops below 10 kg. 4. Run conditioning method for 30 minutes 5. Run blank solvent before sample run.
2	Monthly	1. Change the septum of injector. 2. Change the Glass wool of the liner or change the liner. 3. Check for leaks from the primary gas supply to the GC.

CALIBRATION PROCEDURE OF GC

PURPOSE:

To describe procedure for operation and calibration GC system located in instrument lab.

SCOPE:

This procedure is applicable for operation and calibration GC system located in instrument lab.

ABBREVIATIONS:

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GC – Gas chromatography.

RSD – Relative Standard Deviation

NLT – Not less than

NMT – Not more than

PROCEDURE:

GENERAL GUIDELINES:

Perform the calibrations as per the frequency schedule.

Calibrate the instrument for Reproducibility & Linearity

All apparatus should be wash with soap solution and then water and dry in oven at 110°C. Ensure that there is no trace of solvent. Also ensure that micro syringe should be dry.

REAGENTS & APPARATUS:

Reagents	B.NO /LOT NO	Source /Mfg. By	Valid up to
Dimethyl Formamide			
Methanol			
Acetone			
Isopropyl alcohol			
Micro-syringe 10µl, volumetric flasks, pipettes, etc.			

CHROMATOGRAPHIC CONDITIONS:

Column : DB-624, 30 M x 0.32 mm, 1.8 µ

Injector Temperature : 140° C

Detector Temperature : 250° C

Oven Temperature program : 40° C isotherm for 5 min----30°C/min----------200°C for 5 min

Split ratio : 50

Injection Volume : 0.5 µl

Run Time : 15 min.

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PRECISION OF INJECTION:

Balance ID No.: Calibration Due on:

Weigh accurately 0.1 gm (wt. =) methanol in 100 ml of volumetric flask containing 20 to 30 ml Dimethyl formamide. Sonicate to dissolve and make up to the volume with same solvent, mix well. (1000 ppm)

Fill the blank solution of dimethyl formamide and above calibration solution in GC vials. Keep in the tray and inject five replicates injections.

Sr.No.	Concentration of Methanol standard	Height under methanol response	Retention time
1	1000 ppm methanol solution		
2	1000 ppm methanol solution		
3	1000 ppm methanol solution		
4	1000 ppm methanol solution		
5	1000 ppm methanol solution		
Mean			
STD. DEV.			
RSD %			

Acceptance Criteria:

1. The % RSD for retention time of methanol obtained from five replicate injections of calibration solution is NMT 1.0%
2. The % RSD for height of methanol obtained from five replicate injections of calibration solution is NMT 5.0%.

LINEARITY OF DETECTOR:

Balance ID No.: Calibration Due on:

Weigh accurately 0.1 gm (wt. =) methanol in 100 ml of volumetric flask containing 20 to 30 ml Dimethyl formamide. Sonicate to dissolve and make up to the volume with same solvent, mix well. (1000 ppm)

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Prepare 100 ppm, 200 ppm, 300 ppm, 400 ppm & 500 ppm solutions from above 1000 ppm solution.

Fill the blank solution of dimethyl formamide and above calibration solutions in GC vials. Keep in the tray and inject these five different concentrations solutions, serially.

Sr. No.	Concentration of methanol standard	Height under methanol response
1	100 ppm methanol solution	
2	200 ppm methanol solution	
3	300 ppm methanol solution	
4	400 ppm methanol solution	
5	500 ppm methanol solution	
Correlation coefficient =		

Acceptance Criteria:

Correlation coefficient between five injections should be NLT 0.998.

SYSTEM SUITABILITY

Balance ID No.: Calibration Due on:

Weigh accurately, 0.1 gm (wt. =) Acetone and 0.1 gm (wt. =) Isopropyl alcohol in 100 ml of volumetric flask containing 20 to 30 ml Dimethyl formamide. Sonicate to dissolve and make up to the volume with same solvent, mix well. (1000 ppm)

Inject 0.5 µl single injection to check resolution between Acetone and IPA.

Parameter	Resolution between IPA and Acetone	Tailing Factor	Theoretical Plates
Acceptance Criteria	NLT 2.0%	NMT 2.0%	NLT 2000
Observation		Acetone =	Acetone =
		IPA =	IPA =

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Acceptance Criteria

1. Resolution between IPA and Acetone standard solvent should not be less than 2.0%
2. Tailing factor for each standard solvent peak should not be more than 2.0%
3. Theoretical plates for each standard solvent should not be less than 2000.

ACCEPTANCE CRITERIA:

Sr. No.	Type of Calibration	Acceptance Criteria	Observation
01.	**Precision**		
	a) RSD for RT	NMT : 1.0%	
	b) RSD for Height	NMT : 5.0 %	
02.	**Linearity**		
	Correlation coefficient of Methanol	NLT: 0.998	
03.	**System Suitability**		
	Resolution between Acetone & IPA	NLT 2.0%	
	Tailing factor	NMT 2.0%	Acetone = IPA =
	Theoretical plates	NLT 2000	Acetone =

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			IPA =

PRECAUTIONS:

1. If the instrument fails in calibration or any problem observed in the instrument either during routine analysis or during the preventive maintenance, the concerned personnel investigate the reason for failure.

2. Display a status board as "INSTRUMENT OUT OF CALIBRATION" and inform the service engineer.

REFERENCES :-

1. CRF/R&D/012
2. CRF/R&D/014
3. WI/R&D/029

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SOP & CALIBRATION OF HPLC

Purpose

To describe procedure for operation of system high performance liquid Chromatography' located in instrument lab.

Scope

This is applicable to operation of system high performance liquid Chromatography.

PROCEDURE:

PROCEDURE FOR GENERAL CLEANING:

Ensure that the power supply to the instrument is switched off and main cord is removed from supply.

Clean the instrument with a clean dry cloth every day. A wet cloth dipped in dilute soap solution may be used occasionally.

Precaution must be taken to clean the instrument immediately with dry cloth.

OPERATING INSTRUCTIONS:

Ensure that the instrument is properly connected to the power supply.

Fix the column and prepare the mobile phase.

PREPARATION OF MOBILE PHASE

Use HPLC grade solvent / water & AR/Excel/ HPLC grade reagent only.

Filter the mobile phase through 0.45 membrane filter after mixing it in required proportion and de-gas on ultrasonic bath for about 5 minutes.

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Turn on the computer & the instruments in order to Detector, column oven and pump.

Instrument Start-up Procedure

Open the Chromeleon Console icon on the Desktop (or by navigating Start > All Programs > Thermo Chromeleon 7 > Chromeleon 7).

If the instrument is in Stand-by mode, press the power buttons on the front of the Pump (B), Column Compartment (C), and RS Variable Wavelength Detector (D).

Select the "UltiMate_3000" instrument in the Navigation Pane.

Preparing the Instrument for a Measurement

1. In the Chromeleon Console, verify that the instrument is connected to the software. Under the Instruments tab (bottom of Navigation Pane), the individual component's status can be viewed by selecting "PumpModule," "ColumnOven," or "UV" tabs at the top of the screen.
2. Choose the "PumpModule" tab. If the instrument has been idle for a while or a new mobile phase is being introduced, the solvent lines must first be "purged" before running.**NOTE: Failure to follow the directions below for correctly purging the lines will result in serious damage to the column!!**

- On the instrument, open the cover of the Pump.
- Open the purge valve by turning the knob on the front of the pump to the left until you feel some resistance. Then, turn it slightly past the initial resistance. Close the cover.
- Purge each mobile phase that will be used by selecting "Purge" on the Pump Module tab on Chromeleon. Make sure to confirm that the purge valve is open first.
- Purge will run for 5 minutes. After it is complete, close the purge valve by turning the knob to the right until it is closed.

3. To condition the column prior to separation, choose the appropriate starting mobile phase composition by adjusting the percentages of each appropriate Eluent scale (note that you can only adjust B, C and D – A will automatically adjust to make up 100 %).
4. Set the flow rate to the appropriate rate (1.00 mL/min is typical).
5. Turn the pump "on" by clicking on the button on the left.
6. On the UV tab, turn the lamp "on" so that it can warm up before your separations.

Running Samples

To run a sample in Chromeleon, you must set up the following:

- Sequence: A sequence consists of a collection of injections that will be performed one after the next. Before anything else may be done, a sequence must be created.
- Instrument Method: The instrument method is a series of timed commands to be performed during an injection. Each injection in a sequence must be assigned an instrument method.
- Processing Method: The processing method is a collection of parameters that are used

for evaluating a chromatogram. Each injection in a sequence must be assigned a processing method before it can be evaluated (including determining peak area, retention times, etc.)

Creating a Sequence

- In the upper left of the Console window, choose Create > New Sequence.
- Use the New Sequence Wizard to choose the number of injections (can always change later), naming convention and number of injections per vial.
- You do not need to indicate what Instrumental or Processing methods you will use at this time – it can be done from the Sequence screen later.
- Save the sequence in the appropriate folder on the computer.
- If you make changes to this sequence, you must save it using the disk icon at the top of the screen. If you need to access this sequence during a later session, you can navigate to its folder using the menu on the Navigation Bar.

Creating and assigning and Instrument Method

- In the Chromeleon Console, make sure that "Data" is highlighted in the Navigation Tab and that your sequence is highlighted in the Navigation Tree
- Click on the blank spot under "Instrument Method" in Line 1 (Injection 1).
- Choose "Create New Method"
- Use the Instrument Method Wizard to choose to create a method for the UltiMate 3000.
- On the next screen, input the time for each run. This can be adjusted later if necessary.
- On the following screen identify which mobile phase is in each flask. You do not need to change the pressures in the bottom part of the screen.
- The next screen allows you to set up the mobile phase composition and flow rate for the run. In the first row, input your desired flow rate and the composition of B, C and D (A will be calculated for you).
- If you plan to have an isocratic (i.e. no composition change) elution, you will want to fill all cells in each column with the same numbers. The easiest way to do this is to highlight the top cell and click "F9".
- If you plan to have a gradient elution (i.e. changing composition over time), you should complete the rest of the table to indicate the changes desired.
- On the next screen, indicate the desired temperature for the column separation.
- The next screen allows you to set the desired UV wavelength(s) for detection. The instrumentcan "simultaneously" (really in a quick cycle) monitor up to 4 wavelengths at once.
    - Choose the channel(s) to observe and the desired wavelength(s).
    - If more than one wavelength is chosen, the system will need to be "reset" so that the Data Collection Rate is correct. You may do this by first "unselecting"

the box next to "Use Recommended Values" and then reselecting it. (You will likely get an error message if you do not do this before choosing "Next.")

- After completing the Instrument Method
- Wizard, the program will open the Chromeleon Studio. On this page, you must save and name your new method using the disk icon in the upper left.
- Return to the Chromeleon Console and your sequence list of injections. Select the blank cell under "Instrument Method" for Injection 1 again. Select your newly created method (you may need to click away from the cell and back).
  If you want to use this method for all subsequent injections in the sequence, click "F9" to fill the cells below. Save the sequence.

Running a Sequence

- To start a sequence, return to the Chromeleon Console with your sequence (choose "Data" if needed).
- Click the "Start" button to start the sequence. It will change to "ready" (I think…)
- Prepare your sample for injection. Fill the 100 uL syringe with at least as much as the volume of the injection loop. (The current loop is 20 uL.)
- With the injector in the "Load" position, carefully push the needle into the injector. There will be a little resistance towards the end.
- Fill the loop with more than the volume needed (the loop will always inject a constant volume, any excess with go to waste).
- When ready to inject, quickly turn the injection knob to the right to "inject." You will know that you have correctly injected when the computer shows the instrument running (if more than one wavelength is chosen on the detector, you will also start to hear a clicking sound).
- Wait 30 seconds or so (making sure the loop is completely rinsed into the column) and return the knob to "load." Do not forget to do this before injecting the next sample!!
- When the run is done, you should be able to run the next injection following the same steps.

Sequence notes:

- If you need to alter a method, you can do so without beginning a new sequence. Choose the Instrument Method cell in the next injection and create a new method. Follow the directions above to change the desired parameters and save the new method. Choose this new method for your next injection. You must save the sequence before these changes will take effect.
- If you want to end a run early, choose "Stop" to pause the run and choose to end the run immediately. Before you inject another run, you will need to "unpause" the sequence.
- If your sequence is "stuck" in "Queue." Choose the Instrument tab in the

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Navigation pane and choose the "Queue" tab. Here you can start or end sequences as needed.Sequence notes:

Data Processing (Using Chromeleon Chromatography Studio)

- Once a run has completed, double-clicking the run in the Console Work Area will open the results in the Chromeleon Studio.
- Before any data analysis (including peak identification, retention time and area determination) can be performed, a Data Processing Method must be indicated in the injection sequence. (This may be done before, after or during a sequence run.)
- Choose the blank cell for Processing Method for the first injection in the sequence in the Console.
- Click on "Create New Processing Method"
- Use the Data Processing Method Wizard to choose a "Quantitative" Processing Method. It is not necessary to set up any details for this method before analyzing data but it must be created.
- Name the method as desired. Then, select the first blank cell in the data Processing Method column and select your method. Click "F9" to fill it into all subsequent injections.
- From the Studio, an injection may be selected by choosing Data Processing in the Navigation Pane and double-clicking the run. Any run that is complete will be available in the Studio.
- Under the Channels tab in the Navigation Pane, a different detector signal can be viewed if multiple are used.
- Once an injection has been selected, peak information will be displayed in the window at the bottom of the screen.

Instrument Shut-down Procedure

In the pump module tab, change the solvent to 100 % methanol. Pass the solvent through the column for at least 5 minutes. After this time, shut down the pump and UV lamp. Close all Chromeleon windows. Put all components in standby by pushing the buttons on the front of the instrument.

Standard Preventive maintenance schedule

Sr. No	Frequency	Task
1	Daily	Purge the solvents of each reservoirs before passes the column. Clean the syringe and injector with methanol, water and

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		then mobile phase. Check pressure of column. Give the washing if require. Run blank or mobile phase before sample run.
2	Monthly	1. Clean the filter of reservoir. 2. Replace pump filter assembly frits. 3. Replace inline column filter assembly frit.

CALIBRATION PROCEDURE

PURPOSE:

To lay down a procedure to follow the step for Calibration of HPLC system.

PROCEDURE
FLOW RATE CHECK:

- Disconnect the column and connect the inlet and outlet tubing's with a union.
- Prime all the lines at 5 ml/min flow rate with water and ensure that flow line is free from air bubbles.
- Set the flow rate to 0.5 ml/min; keep it for 15-20 minute. Collect the water from the out let exactly for 10 minute into a reweighed 50 ml beaker. Weigh the beaker and calculate the flow rate by formulae Flow Rate= W2-W1/10
- Perform the same procedure for the flow rate of 1.0 ml/min & 2.0 ml/min.
- Calculate the corresponding flow rate.
- Record the observation in table below
- **Acceptance criteria:** Flow rate should be ±1.0%

Balance No:			**Calibration Due Date:**		
Flow Rate	**Weight of empty beaker(W1)**	**Weight of beaker + water(W2)**	**Weight of water (W)**	**Calculated Flow rate ml/min(W2-W1/10)**	**Tolerance Limit**
0.5ml/min					0.495 – 0.505
1.0ml/mi					0.990 - 1.010

n					
2.0ml/min					1.980 – 2.020

Remark: - The pump performance is found satisfactory / not satisfactory.

ACCURACY OF THE INJECTION VOLUME AND LINEARITY OF DETECTOR:

1. Preparation of Mobile Phase: Mix the 300 ml water and 700 ml volume of methanol in a 1000 ml volumetric flask and filter through 0.45 µ filter paper. Sonicate for 5 minutes.

2. Preparation of Solution: Weight accurately about 50 mg caffeine (primary standard) on a butter paper and transfer it in 50 ml volumetric flask. Dissolve in and dilute to 50 ml with methanol HPLC grade. Dilute 5 ml of this solution to 50 ml with mobile phase. Transfer 2 ml of this solution to 50 ml volumetric flask and dilute up to the mark with mobile phase.

3. Ensure that the instruments are ready for calibration and operation, then procedure is followed.

4. Connect the specified column in the direction of Flow; connect the other end of the column to detector end.

5. Follow the operational procedure and saturate the system with mobile phase at flow rate of 1.0 ml/min as mentioned below.

Chromatographic condition:

Column	: C 18, 250 x 4.6 mm, 5 µ
Flow	: 1.0 ml/min
Wavelength	: 272 nm

Sequence on Autosampler and working list:

Vail No	Injection Volume	No of Injection
1	Blank	2

2	10 µl	3
3	20 µl	3
4	30 µl	3
5	40 µl	3
6	50 µl	3

6. Record the chromatograms and take print outs of all the injections.

7. Note down the area of each injection in logbook. Calculate % relative standard deviation for retention time and peak area.

8. Calculate average area of caffeine at each level and calculate Correlation coefficient.

REPRODUCIBILITY OF INJECTION VOLUME AND LINEARITY OF DETECTOR RESPONCE

Prepare the following solutions:

(**Stock solution:** weight accurately about 50 mg caffeine (primary standard) on a butter paper and transfer it in 50 ml volumetric flask. Dissolve in and dilute to 50 ml with methanol HPLC grade.)

Dilute 5 ml of Stock solution to 50 ml with mobile phase. Prepare the solution shown in below.

Chromatographic condition:

Column	: C 18, 250 x 4.6 mm, 5 µ
Flow	: 1.0 ml/min
Wavelength	: 272 nm

Dilute 5 ml of Stock solution to 50 ml with mobile phase. Prepare the solution shown in below.

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Sr No	Volume of Above solution	Total volume with mobile phase	Concentration of Caffeine in solution
1	1 ml	50 ml	2 ppm
2	2 ml	50 ml	4 ppm
3	3 ml	50 ml	6 ppm

Sequence on Auto-sampler and working list:

Vail No	Concentration Of Solution	Injection volume	No of injections
1	Blank	20 µl	2
2	2 ppm	20 µl	3
3	4 ppm	20 µl	3
4	6 ppm	20 µl	3

Note down the area of each injections in logbook. Calculate % relative standard deviation for retention time and peak area for RT- %RSD NMT 1.0% & Peak Area- %RSD NMT 2.0%

Calculate average area of caffeine at each level and calculate Correlation coefficient.

SYSTEM PERFORMANCE CHECK

1**. Stock solution Caffeine:** weigh accurately 50 mg of caffeine; transfer it in to a 50 ml volumetric flask. Dissolve in and dilute 50 ml with methanol, HPLC grade. Dilute 5 ml of this solution to 50 ml with mobile phase.
2**. Stock solution uracil:** weigh accurately 50 mg of uracil; transfer it in to a 50 ml volumetric flask. Dissolve in and dilute to 50 ml with mobile phase.
3. Pipette out 2 ml of stock solution of caffeine and 2 ml of stock solution in 50 ml volumetric flask and make up the solution with mobile phase.
4. Chromatographic conditions are as follows

Column	: C 18, 250 x 4.6 mm, 5 µ

Flow	: 1.0 ml/min
Wavelength	: 272 nm

5. Inject the solution in duplicate.
6. Check and calculate the peaks of uracil and caffeine for resolution and asymmetry.
7. Take the printouts and note down the values in calibration form.
8. Acceptance criteria: resolution NLT 2.0 and Asymmetry NMT 2.0.

CARRY OVER TEST

1. Chromatographic conditions

Column	: C 18, 250 x 4.6 mm, 5 µ
Flow	: 1.0 ml/min
Wavelength	: 272 nm
Column Temperature	: 40°C

2. Mobile Phase Preparation: Mix the methanol and water in the ratio of 70:30.
3. Preparation of 2000 ppm caffeine solution: weigh accurately about 50 mg of caffeine in 25 ml volumetric flask and make up the mark with the mobile phase.
4. Inject in duplicate of 20 µl volume of blank, i.e. mobile phase and record the chromatogram.
5. Inject the triplicate of 20 µl volume of 2000 ppm solution of caffeine and record the chromatograms.
6. Inject in duplicate of 20 µl volume of blank, i.e. mobile phase and record the chromatogram.
7. Enter the values in calibration form.
8. Calculation: Area of caffeine in Blank x 100 / Area of caffeine 2000 ppm area.
9. Acceptance criteria: carry over should be NMT 0.01% of Caffeine mean area.

CALIBRATION OF GRADINT SYSTEM:

1. Ensure that, the instrument is ready for calibration and start up procedure is followed.
2. Connect the pumps in gradient mode.
3. Disconnect the column and connect inlet tube to the detector.
4. Place the inlet tubing of the pump A into the reagent bottle containing filtered and degassed methanol.
5. Place the inlet tubing in the pump B,C,D in to the reagent bottle containing filtered and degassed 0.0015% solution of caffeine in methanol.

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6. Open the purge valve by rotating it in anticlockwise direction.
7. Set the flow rate of 0.5 ml/min.
8. Allow the methanol to drain for 5 min from all the pump tubing A,B,C,D.
9. Load the following program.

Sr. No	Time	% A	% B	% C	% D
1	00.00 - 10.00 min	100 %	_ _ _ _ _ _	_ _ _ _ _ _	_ _ _ _ _ _ _
2	10.10 - 20.00 min	75 %	25 %	_ _ _ _ _ _ _	_ _ _ _ _ _
3	20.10 - 30.00 min	50 %	_ _ _ _ _ _ _	50 %	_ _ _ _ _ _
4	30.10 - 40.00 min	25 %	_ _ _ _ _ _ _	_ _ _ _ _ _ _	75 %
5	40.10 - 50.00 min	25 %	75 %	_ _ _ _ _ _ _	_ _ _ _ _ _
6	50.10 - 60.00 min	50 %	_ _ _ _ _ _ _	50 %	_ _ _ _ _ _
7	60.10 - 70.00 min	75 %	_ _ _ _ _ _ _	_ _ _ _ _ _ _	25 %
8	70.10 - 80.00 min	100 %	_ _ _ _ _ _ _	_ _ _ _ _ _ _	_ _ _ _ _ _ _

10. Increase the flow rate to 1.0 ml/min.
11. Set the wavelength at 272nm.
12. When the system is equilibrated, and baseline is steady.
13. Start a single run on HPLC system.
14. Run the chromatogram for 80 min.
15. Record the chromatogram.
16. Observe the pattern and calculate the height of each increment from the baseline.
17. Measure the height of the 1st step increment, from the baseline.
18. Similarly, measure the height for each step. If height of step 1 = X mm then the height of each step should increase and come down gradually.

Eg. Step 2 =X * 2
Step 3 =X * 3
Step 4 =X * 3
Step 5 =X * 2
Step 6 =X * 1

19. Observe the chromatogram carefully. The graph must appear like a ladder, with sharp rise at every interval.
20. Make appropriate entries in calibration form.

CALIBRATION OF COLUMN OVEN

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Column temperature set to 50 °C (T1)

Column temperature observed : _____ °C (T2)

Difference (T1 - T2) : _____ °C

Acceptance criteria: The difference between set temperature and observed temperature should be ± 2°C of the set temperature.

Remarks: Calibration is satisfactory / not satisfactory.

CALIBRATION RECORD

FLOW RATE CALIBRATION:

Balance No:			**Calibration Due Date:**		
Flow Rate	**Weight of empty beaker(W 1)**	**Weight of beaker + water(W2)**	**Weight of water (W)**	**Calculated Flow rate ml/min(W2-W1/10)**	**Tolerance Limit**
0.5ml/min					0.495 – 0.505
1.0ml/min					0.990 - 1.010
2.0ml/min					1.980 – 2.020

Acceptance criteria: Flow rate should be ±1.0%

Remark: - The pump performance is found satisfactory / not satisfactory.

ACCURACY OF INJECTION VOLUME AND LINEARITY OF UV DETECTOR:

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Level	Injection volume	Caffeine 4 ppm solution		
		Injection	**Retention Time**	**Peak Area**
I	10 µl.	1		
		2		
		3		
		Mean		
		RSD		
II	20 µl	1		
		2		
		3		
		Mean		
		RSD		
III	30 µl	1		
		2		
		3		
		Mean		
		RSD		
IV	40 µl.	1		
		2		
		3		
		Mean		
		RSD		
V	50 µl	1		
		2		
		3		

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		Mean		
		RSD		

Level	Injection Volume	Mean Peak Area
I		
II		
III		
IV		
V		
Correlation coefficient of the mean peak area and injection volume (NLT 0.999) :		

Remarks: Calibration is satisfactory / not satisfactory.

REPRODUCIBILITY OF INJECTION AND LINEARITY OF UV DETECTOR RESPONCE

Level	Caffeine concentration	Injection	Retention Time	Peak Area
I	2 ppm	1		
		2		
		3		
		Mean		
		RSD		
II	4 ppm	1		
		2		
		3		
		Mean		

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		RSD		
III	6 ppm	1		
		2		
		3		
		Mean		
		RSD		
Correlation coefficient of the mean peak area and injection volume (NLT 0.999) :				

Remarks: Calibration is satisfactory / not satisfactory.

SYSTEM PERFORMANCE CHECK

Observations:

Parameter	Uracil Peak	Caffeine Peak
Retention Time		
Resolution (NLT 2.0%)		
Asymmetry (NMT 2.0%)		

CARRYOVER TEST

Observations:

Mobile Phase(Blank) Determination:

Injection No	Retention Time	Area
1		
2		
Mean		

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Standard Solution Determination: Caffeine 2000 ppm solution

Injection No	Retention Time	Area
1		
2		
3		
Mean		

Mobile Phase (Blank) Determination:

Injection No	Retention Time	Area
1		
2		
Mean		

Acceptance criteria: NMT 0.01% against mean peak area of the standard solution=

Remarks: Calibration is satisfactory / not satisfactory.

CALIBRATION OF GRADIENT SYSTEM

Observations:

Step	Height of the Peak From Baseline	Theoretical Height	Accetance Criteria
I	(X mm)=		
II		X x 2mm =	+/- 2 mm
III		X x 3mm =	+/- 2 mm
IV		X x 3mm =	+/- 2 mm
V		X x 2mm =	+/- 2 mm

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VI		X x 1mm =	+/- 2 mm

Remarks: Calibration is satisfactory / not satisfactory.

CALIBRATION OF COLUMN OVEN

Column temperature set to : 50 °C (T1)

Column temperature observed : _____ °C (T2)

Difference (T1 - T2) : _____ °C

Acceptance criteria: The difference between set temperature and observed temperature should be ± 2°C of the set temperature.

Remarks: Calibration is satisfactory / not satisfactory.

Calibrated By	Checked By
Junior Teacher	Sr.Teacher

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DEPARTMENT OF CHEMISTRY

STANDARD OPERATING PROCEDURE (SOP)
FOR
STUDENTS

This SOP is help full for students while performing practical in the department of chemistry laboratory. SOP of various instruments is available at the site, this SOP is additional for smooth conduct of practical.

Students performing the chemistry practical are required to follow further instructions strictly:

1. Wear apron before entering the lab.
2. Students should cover eyes with goggle and also use shoes to protect feet and legs.
3. Students should be properly dressed so that whole body part must be covered.
4. Follow the instruction of the teacher's during the practical.
5. Do not perform any other practical or reactions without permission of teacher.
6. Always go through the MSDS (Material Safety Data Sheet) of chemicals prior to performing practical.
7. Do not touch or smell any chemicals in the laboratory even though they may seems to be common in practice.
8. Be aware of all the emergency procedures.
9. Always wash the hands before and after completion of practical.
10. In case of any miss-handling of chemicals or any accident/incident inform the teacher immediately.
11. Students should strictly follow the policies of the college.

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Department of Chemistry

STANDARD OPERATING PROCEDURE FOR FUME HOODS IN CHEMISTRY LABORATORIES

This standard operating procedure (SOP) outlines the use of fume hoods.

In accordance with this document, laboratories should use appropriate administrative controls and personal protective equipment when using fume hoods.

DESCRIPTION

- Fume hoods (also called Lab Hoods) are local ventilation devices used to limit your exposure to hazardous fumes, vapours, or dusts when handling chemicals.

WORK PRACTICE CONTROL

- All personnel using the fume hood must be fully trained in its proper operation.

PREPARING THE FUME HOOD FOR WORK

- Check for a date on the certification sticker that is within the last year.
- Check alarms and monitors to indicate proper operation.
- Observe noise and air movement to indicate proper operation.
- Close all windows and doors in the laboratory.
- Set manual controller, if the fume hood has one, to "maximum" for the 100 feet per minute (fpm) position.
- Set sash height indicated by the sticker and arrow; when possible, set the sash at the lowest position.

WARNING: If the alarm sounds or the monitor lights indicate low flow:

1. Stop working.
2. Turn off the equipment.
3. Lower the sash.
4. Notify all individuals in the lab to leave the area if highly toxic or volatile chemicals are being used.

WORKING IN THE FUME HOOD

- Monitor the fume hood when performing ongoing or reactive experiments.
- Keep pedestrian traffic in front of the hood to a minimum.
- Avoid rapid or excessive movement in front of the fume hood.
- Experimental materials and equipment at least 6 inches back from the fac

Safety Precautions:

- All operators must receive training on the safe operation of the fume hood prior to using the equipment.
- Use the required PPE, including lab coat, gloves, and eye/face protection.
- Substitute toxic chemicals with less hazardous materials whenever possible.
- Ensure work area is unobstructed. If materials must be stored in the hood (e.g., in-use waste containers) place items adjacent to a side wall.
- To ensure proper function, the baffles at the lower rear of the hood and the airflow through the front opening must not be obstructed.
- Do not store chemicals in fume hood unless storage is the sole use of the hood. Always work at least 6" (15 cm) in from the front lip of the hood.
- Keep sashes as low as possible when working in the hood.
- Do not extend your head inside of the hood while experiments are being performed.
- Perchloric acid at concentrations >70% must not be used in standard fume hoods.
- Heated or concentrated perchloric acid must be handled in specially designed hoods with wash down features to prevent formation of explosive perchlorates.

DEPARTMENT OF CHEMISTRY

STANDARD OPERATING PROCEDURE (SOP)
FOR
HAZARDOUS CHEMICALS

This SOP is very help full for Hazardous chemicals which is important to disposal of Hazardous chemicals, solvents and reagents as Well as prepared products during practical's safely without any type of hazard to environment and human beings . All students and teaching and non-teaching staff have to follow this SOP.

- Wear protective goggles whenever heating or pouring hazardous chemicals.
- Never mix chemicals together unless you are told to do so.
- Never taste any chemicals.
- If you need to smell the odor of a chemical, waft the fumes toward your nose with one hand. Do not put your nose over the container and inhale the fumes.
- Follow the instructions of your teacher when disposing of all chemicals.
- Wash your hands after handling hazardous chemicals.
- Dispose of all chemicals as instructed by teacher. To avoid contamination do not return chemicals to their original containers
- Be careful when working with chemicals such as acids or bases. Always pour them over the sink rather than over your work area
- When diluting an acid always add small amounts of Acid to Water.
- Rinse acids or bases off of skin immediately. Notify teacher immediately of spills.
- Never taste any chemicals Before undertaking any work become familiar with the hazards of the chemicals involved.
- Keep yourself away from container, while pouring out of siphoning the chemicals.
- Use Suction bulb or vacuum during pipetting of solution.
- Keep inflammable solvents and substances away from naked flame or electric spark.

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DEPARTMENT OF CHEMISTRY

STANDARD OPERATING PROCEDURE (SOP)

for

Laboratory Entry and Exits

Entry

a) Enter the chemistry lab, only after eating sufficient food.
b) When Enter into lab, Students must wear apron/Lab coat.
c) Precious Ornaments are strictly prohibited while entering lab.

Exits

a) Keep the work area clean.
b) Wash hands before exiting from lab.
c) Remove Apron/ lab coat while exiting.
d) Maintain Discipline while leaving the lab.

Do's

- Keep the work area clear of all materials except those needed for your work.
- Extra books, purses etc should kept away from working table.
- Keep your bags on the working bench. Keep them at the designated places only.
- Maintain discipline during practical work.
- In case of any mishap/breakage, report it to your teacher/ lab assistant.

Don'ts

- Do not eat or drink in the laboratory.
- Do not keep your mobile phone near you while working in a chemistry laboratory.
- Do not run around in the laboratory.
- Do not bring visitors in the laboratory.
- Do not wear flowing dresses while in laboratory. Keep your dupatta/ scarf in your bag.
- Do not wear synthetic clothes while working in laboratory. Wear cotton clothes.

- Do not wear shorts while working in the laboratory. Wear full pants/salwar and full sleeve shirts/kurta.
- Do not wear slippers/sandals while working in the laboratory. Wear shoes.
- Do not leave hair open while working in laboratory. Tie it up and make a bun.
- Do not throw a burning matchstick in the sink or in the dustbin.
- Do not throw unused sodium metal in the dustbin. Consult teacher for proper disposal.

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DEPARTMENT OF CHEMISTRY

Standard Operating Procedures (SOPs) for Chemistry Laboratory Non-teaching Staff

Purpose:

The purpose of this SOP is to provide guidelines for non-teaching staff working in a chemistry lab to ensure safety and efficient operation of laboratory procedures.

Scope:

This SOP is applicable to all non-teaching staff working in the chemistry lab.

Responsibilities:

- All non-teaching staff working in the chemistry lab should strictly follow the safety procedures and guidelines provided in this SOP.
- Non-teaching staff must follow the instructions provided by the teaching staff or lab supervisor.
- Non-teaching staff must report any accidents or incidents immediately to the teaching staff or lab supervisor.

Safety Guidelines:

- All non-teaching staff must wear appropriate Personal Protective Equipment (PPE) such as lab coat, gloves, safety glasses, and closed-toe shoes.
- Non-teaching staff should never work alone in the lab. At least one other person should be present in the lab at all times.
- All chemical containers must be clearly labelled with the chemical name, concentration, and hazard warning symbols.
- Non-teaching staff should never taste, smell, or touch chemicals.
- Non-teaching staff should never mix chemicals unless directed by a teaching staff or lab supervisor.
- Non-teaching staff should never dispose of chemicals or hazardous waste in the sink or trash can.
- Follow the proper waste disposal guidelines.

Lab Procedures:

- Non-teaching staff should always follow the standard lab procedures provided by the teaching staff or lab supervisor.
- Non-teaching staff should never modify lab procedures without prior approval from the teaching staff or lab supervisor.
- Non-teaching staff should always double-check measurements, calculations, and observations before proceeding to the next step.
- Non-teaching staff should always record lab data accurately and neatly.

Equipment Use:

- Non-teaching staff should only use equipment they have been trained to use.
- Non-teaching staff should inspect equipment before use and report any damage or malfunction to the teaching staff or lab supervisor.
- Non-teaching staff should always clean equipment after use and return it to the appropriate storage location.

Emergency Procedures:

- Non-teaching staff should be familiar with the emergency procedures and evacuation routes in case of fire, chemical spills, or other emergencies.
- In case of emergency, non-teaching staff should immediately follow the emergency procedures and alert the teaching staff or lab supervisor.
- Non-teaching staff should never attempt to clean up a chemical spill or handle a fire unless trained and authorized to do so.

Conclusion:

- Following the guidelines provided in this SOP will ensure the safety of non-teaching staff and efficient operation of laboratory procedures.
- Failure to follow these guidelines may result in accidents or incidents that can cause injury, damage, or loss.

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DEPARTMENT OF CHEMISTRY

Standard Operating Procedures (SOPs) for Personal Hygiene in Lab

Personal hygiene is extremely important to persons working in a laboratory. Follow following sops for personal hygiene in lab

- Contamination of food, beverages is a potential route to exposure to toxic chemicals through ingestion.
- Laboratory personnel shall not prepare, store, or consume food or beverages in the work area.
- Hand washing is a primary safeguard against inadvertent exposure to toxic chemicals.
- Always wash your hands before leaving the laboratory.
- Wash your hands before leaving the laboratory, and before eating, drinking.
- Wash with soap and running water, with hands held downward to flush the contamination off the hands.
- Dry your hands with clean towels.
- Keeping personal items separate from lab work.
- This will prevent spread of hazardous reagents and cut off a potential exposure route.
- Do not apply cosmetics while in the lab. Applying anything to your face, especially around your mouth or eyes, pose a significant risk of exposure.
- Long pants and shoes completely covering the top of the foot should be worn at all times when working in the lab.
- Lab coats will protect your clothes and your skin from splashes, spills, or other exposures to chemical agents, and flames in some cases.
- Never smell or taste chemicals.
- Do not pipette by mouth.
- Always keep your work area tidy and clean.
- Always tie hair back that is longer in length.
- Make sure that dangling jewellery is secure or avoid wearing it in the first place.

- Never wear sandals or other open toed shoes in the lab. Footwear should always cover the foot completely.
- When working with Bunsen burners, matchboxes, etc. acrylic nails are not allowed.
- When using lab equipment and chemicals, be sure to keep your hands away from your mouth eyes and face.
- Do not use personal handkerchief for lab experiments.
- Use books and journals only in clean area to prevent contamination.
- Never suck pens or chew pencils.
- Roll up loose sleeves.
- Clear up waste, deal with washing up and put things away as you finish with them.
- Cover any cuts, infected wounds or boils you may have with clean, suitable materials.
- Do not spit in the laboratory as this can spread germs.
- Lab coats should be washed regularly and separately from other garments to avoid cross-contamination.
- Do not wear laboratory aprons outside laboratory areas such as canteens, or common areas.

DEPARTMENT OF CHEMISTRY

STANDARD OPERATING PROCEDURE (SOP)
FOR
STORAGE OF CHEMICALS

General Rules: Chemical Storage

Criteria for Storage Area

- Store chemicals inside a closeable cabinet or on a sturdy shelf.
- Shelf should have a front-edge lip to prevent accidents and chemical spills (recommended ¾- inch high).
- Shelving should be secured to wall or floor.
- Ensure that all storage areas have doors with locks.
- Keep chemical storage areas off limits to all students.
- Ventilate storage areas adequately.

Organization

- Organize chemicals first by COMPATIBILITY—not alphabetic succession. Store alphabetically within compatible groups.

Chemical Segregation

- Store acids in a dedicated acid cabinet.
- Nitric acid should be stored alone unless cabinet provides a separate compartment for nitric acid storage.
- Store highly toxic chemicals in a dedicated, lockable poison cabinet that has been labeled with a highly visible sign.

Chemical Segregation

- Store volatile and odoriferous chemicals in a ventilated cabinet.
- Store flammables in an approved flammable liquid storage cabinet. ♣

- Store water sensitive chemicals in a water-tight cabinet in a cool and dry location segregated from all other chemicals in the laboratory.

Storage Don'ts

- Do not place heavy materials, liquid chemicals, and large containers on high shelves.
- Do not store chemicals on tops of cabinets.
- Do not store chemicals on the floor, even temporarily.
- Do not store items on bench tops, in laboratory chemical hoods or under sinks.

Storage Don'ts

- Do not store chemicals on shelves above eye level.
- Do not store chemicals with food and drink.
- Do not store chemicals in personal staff refrigerators, even temporarily.
- Do not expose stored chemicals to direct heat or sunlight, or highly variable temperatures.

Proper Use of Chemical Storage Containers

- Never use food containers for chemical storage.
- Make sure all containers are properly closed.
- After each use, carefully wipe down the outside of the container with a paper towel before returning it to the storage area.
- Properly dispose of the paper towel after use.

COMPUTER LABS STANDARD OPERATING PROCEDURE

A. UG & PG Computer Labs

Lab capacity and Seating Arrangement

The departments of Computer Science(C.S) and Information Technology (I.T) have been allotted four labs with over 192 computers in all. The 1:1 student ratio is maintained while conducting the practicals. All computer labs are equipped with high speed internet, printers and wall mounted projectors. The students are able to share the files and softwares on a shared folder via the LAN.

Lab Protocols

Each lab has a MCB panel to turn on the power supply which powers on/off the entire lab electricity isolating it from the outer switches. The internet control is managed by D-Link switches to turn off the internet services during exams and evaluations.The labs are cleaned every alternate day by the cleaning staff.

Lab Services

- According to the timetables of the students enrolled in UG and PG programs, all computers are used to conduct practical sessions.
- Computers are made accessible to all PG and UG students to ensure that they can complete their practical assignments, project work, and software development on schedule.
- The Computer labs are used for the following purposes
    - Conducting C.S/I.T Practicals as per schedule
    - For conducting Practical Examinations
    - For lab assignments
    - Research work of faculties and students
    - practical sessions of Workshops/ Conferences/FDPs organised by the Department of Computer Science/Information Technology
    - Intra departmental lab sessions of Department of Geography (for Geographic Information Systems) and Biotechnology (SPSS)
- The availability of updated software and lab manuals, which operate as a procedural framework outlining the laboratory tasks, facilitates the smooth operation of the labs.
- All four labs are equipped with Network Printers.

Lab Operations

- All labs are equipped with the updated softwares as prescribed by the University of Mumbai from time to time.
- The students' entries in the daily log are mandatory before using the system.
- Three full time lab assistants are appointed for the maintenance and troubleshooting issues.
- The Lab Assistants are responsible for
    - Installation and Updation of prescribed softwares
    - Checking the Student entry register and troubleshooting on the system problems
    - Antivirus installation and updates
    - Data backup and Sharing services
    - Periodic formatting of computers (only when essential)

- Preparing the lab for practical examinations (deleting student files before practical exams)
- Keeping track of the inventory allotted (UPS, Printers, Projectors, Computer and Network accessories) in the stock register
- Maintaining lab discipline and handling printouts to students
- Assisting the faculties in technical issues during the practical examinations.

B. Internet of Things(IOT)/3D Printing Lab

The College in collaboration with GROK Learning have set up an IOT/3D printing lab for facing the employability challenges. The newly established lab will be acting as a learning platform to bridge the gap between Education and Industry using the following approach:

- Empower faculty to teach hands on, converting the theory into practical solutions.
- Impart hands-on integrated learning to build industry solutions right from the first year.
- Focus on a problem-solving approach and remove the fear of programming with the help of Grok's no coding Tool.
- Enable students with experience in building 25 to 50 real industry solutions by the end of 3rd year.
- Faculty members need not to be programming experts but they should be able to connect academic concepts to real industry needs through applications.

The IOT/3D printing lab is equipped with the latest configuration machines, a seating capacity of 35 students and high speed internet to work on the GROK cloud platform. The college has procured 10 GROK kits and a 3D Printer from GROK Learning.

Service Description	Number of Users	Cost and Pricing (Subject to Additional GST Charges)
Grovator™ with 10 (ten) Grok IoT Kits, 10 (ten) Grok Robotics Kits, 1 (one) 3D Printer	10 Concurrent Users	i) IoT Kits – Rupees 35,000 (thirty-five thousand) for each IoT Kit. ii) Robotics Kits – Rupees 35,000 (thirty-five thousand) for each Robotics Kit. iii) 3D Printer – Rupees 50,000 (fifty thousand) for each 3D Printer.

Annual subscription charges: **Rs. 11 Lakhs + Taxes** for 10 concurrent Authorised Users

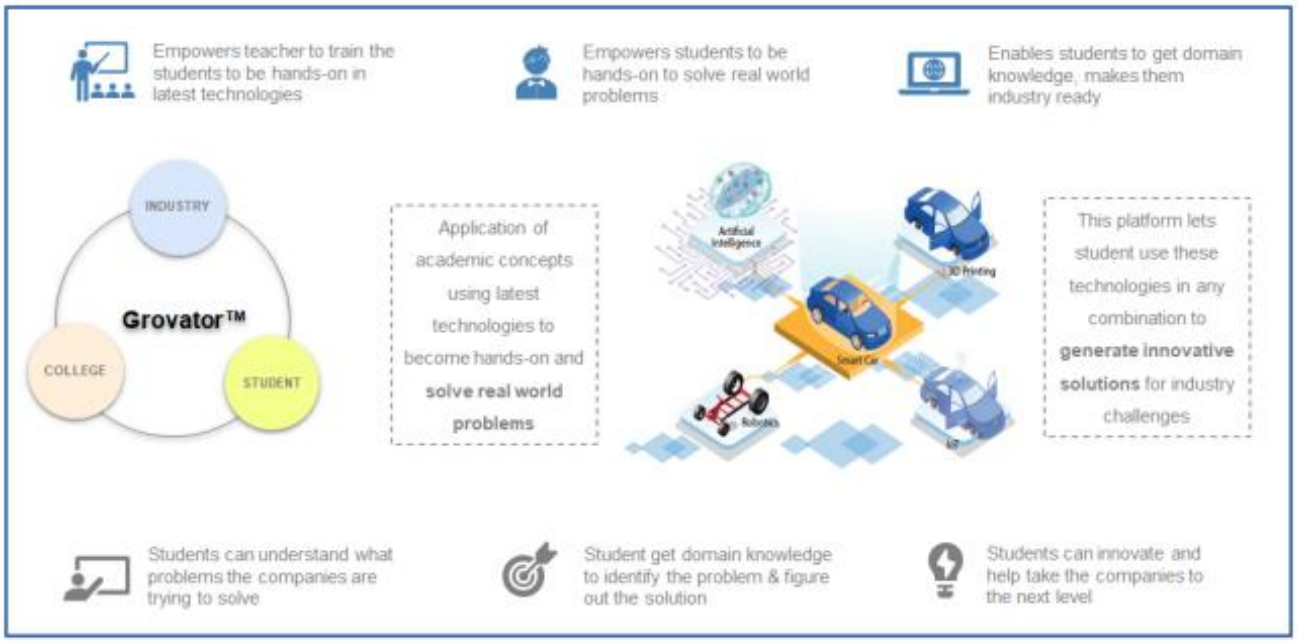

Figure: The Grovator™ Platform

Lab capacity and Seating Arrangement

- The IOT/3D Printing Lab has a seating capacity of 35 students.
- Two teaching faculties monitor the IOT/3D printing sessions.
- Each IOT batch is divided into 20 students (2 students per Kit)
- The students have to enrol for the IOT/3D Printing Course before attending the sessions.
- Each group needs to submit their College ID card before taking a kit and will get the Id back on the return of the Kit.
- The IOT sensors and components are counted before the kits are used and also after the kits are submitted.

Lab Protocols

Each lab has a MCB panel to turn on the power supply which powers on/off the entire lab electricity isolating it from the outer switches. The internet control is managed by D-Link switches to turn off the internet services during exams and evaluations.The labs are cleaned every alternate day by the cleaning staff.


DigiPro 3D
GPS Map Camera
Palghar, Maharashtra, India
dandekar college, PQ66+R2X, Mission Compound, Banjar para, Boisar, Palghar, Maharashtra 401404, India
Lat 19.712079°
Google

3D Printer

IOT Sessions in Progress

C.Internet of Things(IOT)/3D Printing Lab

8085 Microprocessor Kit:

- It was first designed in the year 1977 by Intel. 8085 is an 8-bit modified form of a microprocessor.
- It processes the binary data as per the instruction stored in memory and gives a suitable outcome.
- 8085 microprocessor Trainer kit is **proposed to smooth the progress of learning and developing designs of 8085 microprocessor family from Intel**.
- This kit can be programmed using a PC's 101/104 Keyboard without using a pc, thus making this kit as a standalone kit.
- User can enter programs in Assembly languages.
    - One can find its applications in ovens, gadgets, washing machines, and various other devices. The microprocessor kit is a single-board computer that helps in practicing 8085 microprocessors.
    - The kit costs quite little and is good for the learning process. It allows one to start from a low-level language and gradually reach high-level programming.

Key Features of 8085 Microprocessor Trainer Kit

- Devices : 8085(Intel)
- Clock : 6.144MHz crystal.
- 32KB-SRAM for user Data.
- 16KB-EEPROM for Monitor Program.
- 2×16 Char LCD display.
- 48 Programmable I/O Pins for (2 x 8255)
- Three 16-bit programmable timer (8253/8254)
- 40-Pin FRC connector for Bus Extension.

Digital Electronics Kit:

· A Digital Trainer Kit is an educational tool that helps students learn the concepts of digital electronics using a microcontroller.

· It gives hands-on experience in designing and simulating circuits on breadboards. It is a training tool for engineering students.

· The basic gates are AND, OR, NOT, NAND and NOR

· It is also designed to offer an option for students to quickly build, modify and troubleshoot all sorts of circuits and it is ideal for academics to use it as a learning aid tool.

Features:

· Completely self – contained standalone unit.

· Built in IC based DC regulated power supply.

· Test points provided on panel at various stages in the circuit.

· Set of required number of Patch cords.

· Strongly supported by a comprehensive instruction manual complete with theory and operating details.

Experiments:

· To Study the AND, OR, NOT, NAND, NOR, XOR, XNOR Gates, Flip-Flops, Counters etc.

· To study SR,D,JK Flip-Flop

· To Study the Counters

· To Study the Shift Register.

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- To Study the Code Convertor.

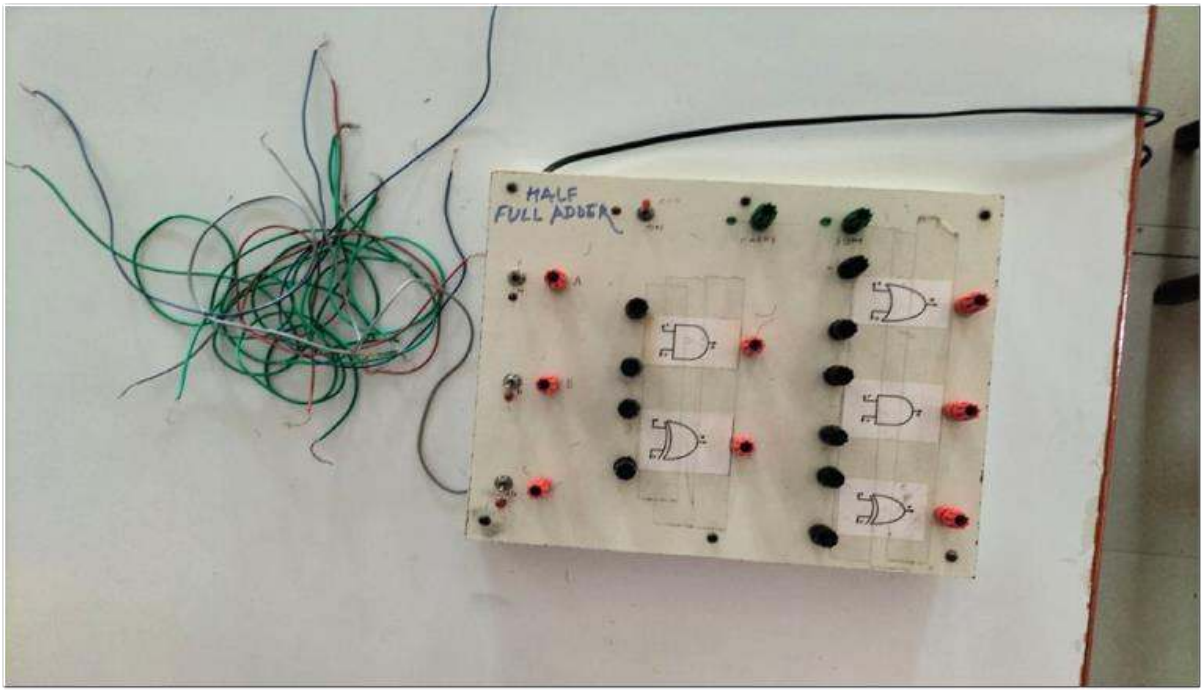
Snaps

Hardware Lab

Oscilloscope

Microprocessor Kit

Hardware Lab



Full/Half Adder

COMPUTER LABS STANDARD OPERATING PROCEDURE

A. UG & PG Computer Labs

Lab capacity and Seating Arrangement

The departments of Computer Science(C.S) and Information Technology (I.T) have been allotted four labs with over 192 computers in all. The 1:1 student ratio is maintained while conducting the practical's. All computer labs are equipped with high speed internet, printers and wall mounted projectors. The students are able to share the files and software's on a shared folder via the LAN.

Lab Protocols

Each lab has a MCB panel to turn on the power supply which powers on/off the entire lab electricity isolating it from the outer switches. The internet control is managed by D-Link switches to turn off the internet services during exams and evaluations. The labs are cleaned every alternate day by the cleaning staff.

Lab Services

- According to the timetables of the students enrolled in UG and PG programs, all computers are used to conduct practical sessions.
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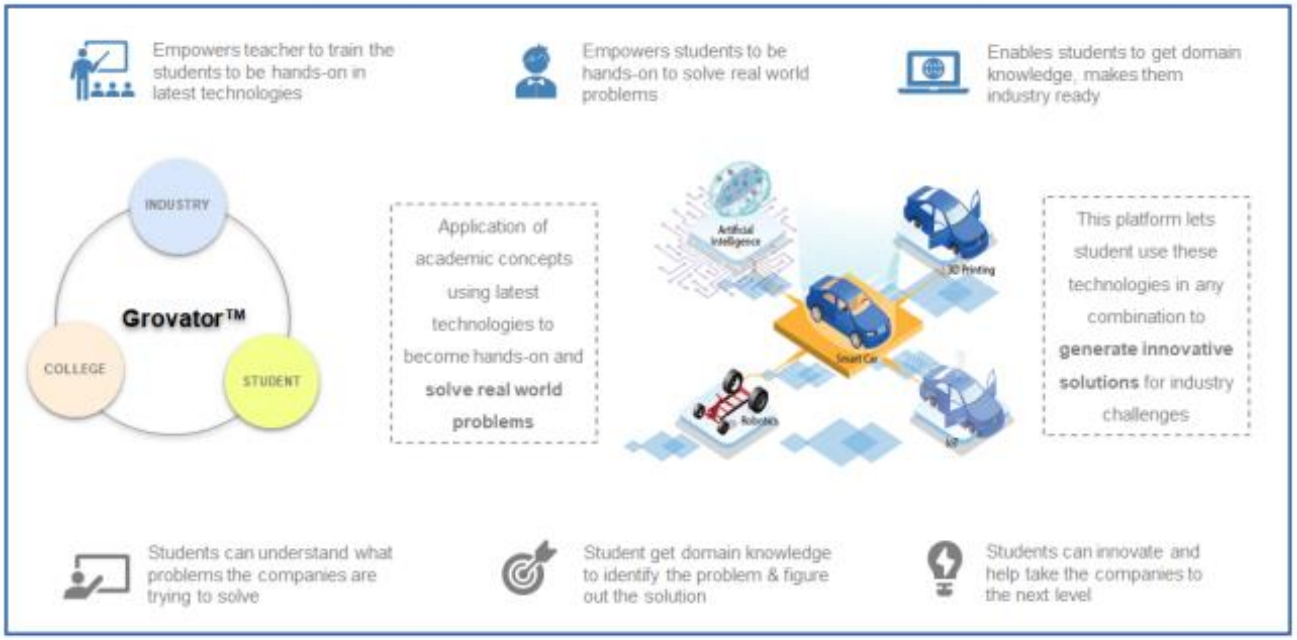

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Oscilloscope

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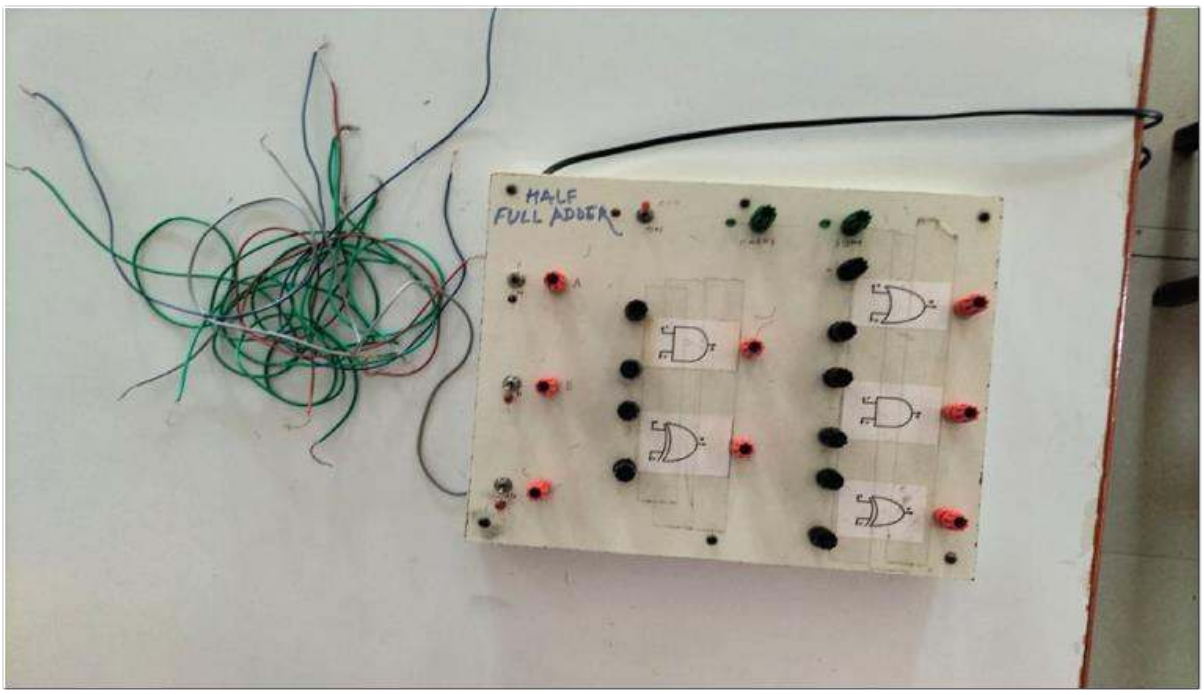
Hardware Lab



Full/Half Adder

Sonopant Dandekar Arts, V.S. Apte Commerce and M.H. Mehta Science College, Palghar

Internal Quality Assurance Cell

Academic Year: 2021-2022

SOP for Tutorials

Tutorial Advisory for Students

Preamble: Students must behave like good cultured individuals upholding high moral, ethical values and do not break the decorum of the classroom. The purpose of the tutorial is to provide each student a hands-on understanding of mathematical concepts.

There shall be a tutorial session of 48 minutes duration and on the time and days prescribed as per the time table.

DO'S

1. Join the link provided 5 minutes before start of the tutorial.

2. Ensure that you have necessary stationery (pen, pencil, eraser, scale etc,) and calculators of the permitted model and type (non-programmable electronic calculators).

3. If there is any emergency/urgent need of any sort speak to concerned professor.

4. Follow the instructions of the tutorial conducting professor.

5. While performing the tutorial if you want to speak then raise your hand first, take permission and then speak in a soft and dignified manner.

6. For extra problems solving, make separate tutorial notebook.

7. Make sure that you are in a place of strong internet connection.

DON'TS

1. Do not Join the link late.
2. Do not on your camera unnecessarily.
3. Do not unmute or speak during the tutorial session.
4. Do not argue with the professor for any reason.
5. Do not attempt to copy the writing part of any tutorial from the internet.
7. Do not leave the online tutorial class for any reason unless permitted by your professor.
8. Do not share the link of the online tutorial session to anyone.
9. Do not disturb the professor while explanation and wait for your turn to speak.

Sonopant Dandekar Arts, V.S. Apte Commerce and M.H. Mehta Science College, Palghar

Internal Quality Assurance Cell

Academic Year: 2021-2022

SOP for Practical

Practical Advisory for Students

Preamble: Students must behave like good cultured individuals upholding high moral, ethical values and do not break the decorum of the classroom. It is the purpose of the practical to provide each student a hands-on understanding of mathematical concepts.

For Semester I: One Practical (2L) per week per batch for courses USMT101, USMT 102 combined (the batches to be formed as pre scribed by the University). Each practical session is of 48 minutes duration.

For Semester II: One Practical (2L) per week per batch for courses USMT201, USMT202 combined (the batches to be formed as pre scribed by the University). Each practical session is of 48 minutes duration.

DO'S

1. Join the link provided 5 minutes before start of the practical

2. Ensure that you have necessary stationery (pen, pencil, eraser, scale etc,) and calculators of the permitted model and type (non-programmable electronic calculators).

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Sonopant Dandekar Arts, V.S. Apte Commerce and M.H. Mehta Science College, Palghar

Internal Quality Assurance Cell

Academic Year: 2021-2022

SOP for Practical Examination

SOP For Supervisor

Preamble: Examination being solemn activity the office bearers are required to perform their duties with complete sincerity upholding the highest principles so that all examinees are provided with equal and fair opportunity of performance.

1) Share the proper link of the practical exam 10 minutes before the commencement of the exam.

2) Make sure that the correct link is sent in the correct group.

3) Do not allow students to join the meeting 5 minutes after the commencement of the practical exam without a genuine reason.

4) Do not allow students to communicate amongst them.

5) Point number 3, 4 and any other malpractices to be immediately brought to the notice of the HOD.

6) Verify that correct Question Papers based on the pattern and subject is sent to the students.

7) Do not talk on mobile phones or indulge in any other activity which distracts your attention from invigilation.

9) Ensure that students are not disturbed due to any reason during the examination.

10) Stop accepting responses from the student 5 minutes after the end of the practical exam.

Examination Advisory for Students

Preamble: Examinees must behave like good cultured students upholding high moral, ethical values and do not attempt to take advantage by employing any kind of unfair means. It is the purpose of the examination system to provide each examinee equal and fair opportunity.

There shall be a Semester-end practical examinations of two hours duration and 100 marks for each of the courses USMT101, USMT102 of Semester I and USMT201, USMT202 of semester II.

DO'S

1. Join the meeting 15 minutes before start of the exam.

2. Ensure that you have necessary stationery (pen, pencil, eraser, scale etc,) and calculators of the permitted model and type (non-programmable electronic calculators).

3. If there is any emergency/urgent need of any sort speak to the exam supervisor only.

4. Follow the instructions of the exam supervisor.

5. Visit the Mumbai University Website to educate yourself about the punishment for indulging unfair means.

6. Contact the concerned supervisor immediately in case of any emergency or loss of network.

7. The link will be deactivated after 30 minutes from the commencement of the exam, so start submitting Google forms before 5 minutes.

DON'TS

1. Do not join the link late.

2. Do not turn off your camera for any reason while the practical is in progression.

3. Do not speak or even look at any other person for whatever reason.

4. Do not argue with exam supervisor for any reason.

5. Do not open any new tab or use mobile phones or any other material for purpose of copying either deliberately or unknowingly.

6. Do not attempt to copy even by employing non-written communication means. (Visit the Mumbai University website for ordinances on this issue.)

7. Do not leave the meeting for any reason unless permitted by supervisor.

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Internal Quality Assurance Cell

Academic Year: 2021-2022

SOP for Practical

Practical Advisory for Students

Preamble: Students must behave like good cultured individuals upholding high moral, ethical values and do not break the decorum of the classroom. It is the purpose of the practical to provide each student a hands-on understanding of mathematical concepts.

There shall be a practical session of three hours duration and on the time and days prescribed as per the time table.

DO'S

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2. Ensure that you have necessary stationery (pen, pencil, eraser, scale etc,) and calculators of the permitted model and type (non-programmable electronic calculators).
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4. Follow the instructions of the practical conducting professor.
5. While performing the practical if you want to speak then raise your hand first, take permission and then speak in a soft and dignified manner.
6. For extra problems solving, make separate practical notebook.
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There shall be a Semester-end practical examinations of three hours duration and 150 marks for each of the courses USMT301, USMT302, USMT303 of Semester III and USMT401, USMT402, USMT403 of semester IV.

DO'S

1. Join the meeting 15 minutes before start of the exam.

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There shall be a Semester-end practical examinations of three hours duration and 200 marks for each of the courses USMTP05 of Semester V and USMTP06 of semester VI. In semester V the practical examination will be conducted by the college and in Semester VI the practical examination will be conducted by the University.

DO'S

1. Join the meeting 15 minutes before start of the exam.

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1. Do not join the link late.

2. Do not turn off your camera for any reason while the practical is in progression.

3. Do not speak or even look at any other person for whatever reason.

4. Do not argue with exam supervisor for any reason.

5. Do not open any new tab or use mobile phones or any other material for purpose of copying either deliberately or unknowingly.

6. Do not attempt to copy even by employing non-written communication means. (Visit the Mumbai University website for ordinances on this issue.)

7. Do not leave the meeting for any reason unless permitted by supervisor.

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

DEPARTMENT OF PHYSICS

STANDARD OPERATING PROCEDURE (SOP)

The Physics Department Laboratories are the following:

Physics Lab 1: Room No-27

Physics Lab 2: Room No-28

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

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

Department and Laboratory Cleanliness:

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

General Physics Laboratory safety practices:

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

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

Policies on the Use of Laboratory rooms:

1. The key to all laboratory rooms are kept by the technicians. The technicians will open the lab rooms only when there are laboratory classes.

2. The laboratory Assistance must be the first and the last person in the laboratory room. Students are NOT allowed to enter the laboratory unless the Assistance is already present.

3. Only those officially enrolled in Physics Laboratory Courses are allowed to enter the laboratory.

4. Prohibited from smoking, eating, drinking, and littering in all physics laboratories.

5. Good housekeeping and safety precautions should be observed at all times.

6. Use all laboratory fixtures properly. Do not sit on tables and do not open cabinets or lockers unless there is an instruction to do so.

7. Maintain the cleanliness of the lab at all times.

8. The instructor should see to it that every utility (equipment, lights, water, gas, etc.) is turned off.

Policies on the Conduct of an Experiment:

1. Students are advised to read all precautionary notes on all pieces of equipment before using them. All questions about safety precautions on the equipment being used must be addressed to the lab instructor.

2. The lab instructor must first check the setup for experiments requiring the use of electrical components before any of these are plugged in or turned on. In case of faulty equipment, the instructor must be informed immediately so that a replacement can be secured from the Physics Laboratory.

3. Experiments involving the use of boiling water, heaters, and the like must be performed close to the water sinks in the lab.

4. Chemicals used in some experiments must be handled with utmost care. Used and unused chemicals must be returned to the Physics Laboratory as soon as the experiment is finished. Chemicals should never be thrown into the water sinks or the trash bins.

5. The lab technicians may be requested by the lab instructor to assist during a lab experiment but they are not required to stay in the lab rooms.

Borrowing Procedures and Use of Equipment:

1. The lab technicians in the Physics Lab are responsible for the safekeeping and lending of all equipment used in the Physics Teaching Lab.

2. All equipment necessary for physics experiments may be borrowed from the technicians at the Physics Lab.

3. Students must present an ID before any lab equipment is loaned.

4. Borrow only the required equipment which are specified in your experiment.

5. The borrower and his/her group are held responsible for all equipment borrowed from the Physics Lab.

6. All equipment borrowed must be returned upon completion of the experiment.

Stock Verification of Library Books:

Noting the Accession Number

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

Re-verifying the missing Books

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

Equipment Maintenance:

I. Lab Equipment

Entry of Faulty Instruments

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

Apply for Repair

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

Verification and Bill Processing

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

Procurement of Goods/Items/Equipment:

Steps for Non-Recurring items:-

Issuing the Item

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

Labeling the Procured Item

1. Label procured items with reference number.

Maintaining Register

1. A register is maintained for the equipment.

Steps for Recurring items:-

Issuing the Item

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

Maintaining the Record

1. Record is maintained for the usage.

Standard Operating Procedure (SOP) for Entering a Zoology Laboratory in College

1) Personal Protective Equipment (PPE): Before entering the zoology laboratory, I will ensure that I am wearing the appropriate PPE as per the laboratory guidelines. This may include a lab coat, gloves, safety goggles, and closed-toe shoes. I will also tie back long hair and remove any loose jewelry or accessories.

2) Safety Precautions: I will follow all safety precautions and protocols while inside the laboratory, including but not limited to, not eating, drinking, or applying cosmetics, washing hands before and after handling animals or equipment, using designated waste disposal containers, and reporting any spills or accidents immediately to the laboratory staff..

3) Equipment and Resource Usage: I will use laboratory equipment and resources responsibly,

4) Documentation and Record Keeping: I will maintain accurate and complete records of my experiments, observations, and findings in the zoology laboratory. I will also comply with any data management and record-keeping protocols established by the laboratory staff or faculty.

5) Laboratory Rules and Regulations: I will familiarize myself with and strictly adhere to the laboratory rules and regulations, as provided by the college or laboratory staff. This may include guidelines on handling live animals, using equipment, disposing of waste, and maintaining cleanliness and hygiene.

I understand that failure to comply with this SOP may result in denial of access to the zoology laboratory or disciplinary action, and I am committed to upholding these guidelines to ensure a safe and productive learning environment for myself and others.

Standard Operating Procedure (SOP) for Autoclave

An autoclave is a device used to sterilize laboratory equipment, media, and other items using high-pressure steam. Here are step-by-step instructions for operating an autoclave:

Step 1: Preparation

1. Check the autoclave to ensure that it is clean and free of any debris or residual materials from previous uses.
2. Inspect the door gasket and other seals to ensure that they are intact and in good condition.
3. Fill the autoclave chamber with distilled water to the appropriate level and ensure that the drain valve is closed.

Step 2: Loading the Autoclave

1. Load the items to be sterilized into autoclave-safe containers, such as glass or plastic bottles, and ensure that the containers are properly sealed and labeled.
2. Place the containers on the autoclave tray or rack, ensuring that there is sufficient space between them for steam circulation.
3. Close the autoclave door and ensure that it is properly latched and sealed.

Step 3: Selecting the Cycle

1. Select the appropriate autoclave cycle, following any laboratory protocols or experimental requirements.
2. Ensure that the cycle parameters, such as temperature, pressure, and time, are set to the appropriate values for the items being sterilized.

Step 4: Running the Cycle

1. Start the autoclave cycle.
2. Monitor the autoclave during the cycle to ensure that the temperature, pressure, and other parameters remain within the desired range.
3. After the cycle is complete, allow the autoclave to cool down and depressurize before opening the door.
4. Open the autoclave door slowly and carefully, and use appropriate personal protective equipment, such as gloves and goggles, to avoid exposure to steam or hot items.
5. Remove the sterilized items from the autoclave and allow them to cool to room temperature before handling.

Step 5: Cleaning and Maintenance

1. After completing the autoclave cycle, clean the autoclave chamber, tray, and other surfaces with a suitable disinfectant or cleaning solution, following the manufacturer's instructions and laboratory protocols.
2. Remove any residual water from the autoclave chamber and ensure that all valves and drains are closed.
3. Inspect the autoclave for any damage or wear and report any issues to laboratory staff or maintenance personnel.
4. Store the autoclave and other equipment in a clean and dry location.
5. Follow any cleaning and maintenance protocols established by the laboratory or manufacturer to ensure the longevity and accuracy of the autoclave.

Standard Operating Procedure (SOP) centrifuge

A centrifuge is a laboratory instrument used to separate components of a liquid sample based on their density by using centrifugal force. Here are detailed instructions for operating a typical centrifuge:

Step 1: Setup and Preparation

1. Gather all the necessary equipment, including the centrifuge, appropriate centrifuge tubes, and the liquid sample to be processed.
2. Ensure that the centrifuge is clean and in good working condition, following the manufacturer's instructions.
3. Select the appropriate type of centrifuge tubes for the sample being processed, such as microcentrifuge tubes, test tubes, or conical tubes, and ensure they are properly labeled.
4. Balance the tubes by placing them in opposite positions on the centrifuge rotor, ensuring that they are evenly distributed to maintain balance during operation and prevent damage to the centrifuge.

Step 2: Loading the Sample

1. Open the centrifuge lid and place the balanced centrifuge tubes securely in the centrifuge rotor, ensuring they are properly seated in the tube holders or adapters.
2. Close the centrifuge lid securely, following the manufacturer's instructions to ensure safe and proper operation.
3. Verify that the centrifuge is set to the correct speed or RPM (revolutions per minute) and time for the specific sample being processed, following the manufacturer's instructions and any experimental protocols.
4. Start the centrifuge, following the manufacturer's instructions, and allow it to run for the designated time or until the centrifugation process is complete.

Step 3: Stopping the Centrifuge

1. Once the centrifugation process is complete, stop the centrifuge according to the manufacturer's instructions.
2. Wait for the centrifuge rotor to come to a complete stop before opening the centrifuge lid to avoid injury from moving parts.
3. Carefully open the centrifuge lid, taking caution not to disturb the balance of the centrifuge tubes.
4. Using appropriate precautions, such as wearing gloves and eye protection, remove the centrifuge tubes from the centrifuge rotor, taking care not to spill or mix the contents of the tubes.

Step 4: Cleaning and Maintenance

1. Wipe down the centrifuge rotor and chamber with a clean, damp cloth to remove any residue or spills.
2. Clean the centrifuge tubes and caps, if necessary, following the laboratory's standard cleaning protocols.
3. Inspect the centrifuge for any damage or wear and report any issues to laboratory staff or maintenance personnel.
4. Store the centrifuge tubes and caps in a clean and dry location, following the laboratory's storage protocols.
5. Follow any cleaning and maintenance protocols established by the laboratory or manufacturer to ensure the longevity and accuracy of the centrifuge.

Standard Operating Procedure (SOP) Compound Microscope

A compound microscope is a common laboratory instrument used to magnify small specimens or samples for microscopic observation. Here are detailed instructions for operating a typical compound microscope:

Step 1: Setup and Preparation

1. Place the microscope on a clean, level and sturdy surface, such as a laboratory bench or table.
2. Adjust the height of the microscope so that it is comfortable to use while sitting or standing.
3. Gather the specimen or sample to be observed and place it on a clean microscope slide, ensuring that it is properly prepared and positioned.

Step 2: Illumination

1. Adjust the intensity of the light coming to the microscope from an appropriate source to the desired level.
2. Adjust the condenser, if available, to the appropriate position for optimal illumination of the specimen.
3. If using a microscope with a mirror, adjust the mirror to reflect light onto the specimen, if needed.

Step 3: Objective Selection

1. Rotate the nosepiece (the part that holds the objectives) to select the lowest magnification objective and position it over the specimen.
2. Lower the stage using the coarse adjustment knob until the objective is almost touching the specimen, but without making contact.
3. Look through the eyepieces and adjust the focus using the coarse adjustment knob until the specimen comes into focus.

Step 4: Fine Focus and Magnification Adjustment

1. Use the fine adjustment knob to further focus the specimen and obtain a sharp and clear image.
2. Once the image is in focus, rotate the nosepiece to select a higher magnification objective and use the fine adjustment knob to re-focus the specimen.

Note: that the higher the magnification, the smaller the field of view and the shorter the working distance, so use caution to avoid hitting the slide or damaging the objective.

Step 5: Observing and Recording

1. Observe the specimen carefully, paying attention to its details and structures using both eyes and adjusting the focus as needed.
2. Use the microscope's stage controls to move the slide and examine different areas of the specimen.
3. Take notes or record your observations as needed for your specific purpose or experiment.

Step 6: Shutdown and Cleanup

1. Rotate the nosepiece to the lowest magnification objective and raise the stage using the coarse adjustment knob.
2. Remove the specimen slide and any other materials from the microscope stage.
3. Clean the microscope lenses, stage, and other parts with a lens cleaning solution or lens paper to remove any oil or debris.
4. Cover the microscope with a dust cover or store it properly following the manufacturer's instructions.

Standard Operating Procedure (SOP) Conductivity meter

Conductivity meters are used to measure the electrical conductivity of a solution. Here are step-by-step instructions for operating a conductivity meter:

Step 1: Preparation

1. Ensure that the conductivity meter is clean and calibrated according to the manufacturer's instructions.
2. Fill a clean and dry beaker or container with the solution to be measured.
3. Insert the conductivity probe into the solution, ensuring that the probe is fully submerged and not touching the sides or bottom of the container.

Step 2: Calibration

1. Turn on the conductivity meter and allow it to warm up according to the manufacturer's instructions.
2. Calibrate the meter using a standard calibration solution of known conductivity.
3. Rinse the probe with distilled water and dry it with a clean tissue or cloth.

Step 3: Measuring Conductivity

1. Insert the probe into the solution to be measured, ensuring that the probe is fully submerged and not touching the sides or bottom of the container.
2. Wait for the meter to stabilize and display the conductivity reading, which is usually expressed in units of microsiemens per centimeter (μS/cm) or millisiemens per centimeter (mS/cm).
3. Record the conductivity reading and rinse the probe with distilled water and dry it with a clean tissue or cloth.

Step 4: Cleaning and Maintenance

1. After completing the conductivity measurement, clean the probe with a suitable cleaning solution or distilled water.
2. Store the probe in a clean and dry location, following the laboratory's storage protocols.
3. Follow any cleaning and maintenance protocols established by the laboratory or manufacturer to ensure the longevity and accuracy of the conductivity meter

Standard Operating Procedure (SOP) Electrophoresis.

Electrophoresis machines are used for separating and analyzing charged molecules, such as DNA or proteins. Here are step-by-step instructions for operating both horizontal and vertical electrophoresis machines:

Horizontal Electrophoresis:

Step 1: Preparation

1. Prepare the gel according to the protocols and requirements of the experiment, including any necessary additives or buffers.
2. Assemble the gel tray, ensuring that the electrodes are properly connected to the power supply.
3. Load the gel with the sample to be analyzed.

Step 2: Electrophoresis

1. Fill the buffer chamber with the appropriate buffer solution.
2. Place the gel tray into the buffer chamber, ensuring that the electrodes are fully submerged in the buffer solution.
3. Connect the power supply to the electrodes and turn on the electrophoresis machine.
4. Allow the electrophoresis to proceed for the recommended time and voltage, following the protocol of the experiment.
5. Turn off the power supply and remove the gel from the tray.

Step 3: Staining and Visualization

1. Stain the using a suitable staining solution.
2. Visualize the separated molecules using an appropriate imaging system.

Step 4: Cleaning and Maintenance

1. After completing the electrophoresis, clean the gel tray or cassette with a suitable cleaning solution or distilled water.
2. Store the electrophoresis machine in a clean and dry location, following the laboratory's storage protocols.
3. Follow any cleaning and maintenance protocols to ensure the longevity and accuracy of the electrophoresis machine.

Vertical Electrophoresis:

Step 1: Preparation

1. Prepare the gel according to the protocols and requirements of the experiment, including any necessary additives or buffers
2. Assemble the gel ensuring that the electrodes are properly connected to the power supply.
3. Load the gel with the sample to be analyzed.

Step 2: Electrophoresis

1. Fill the buffer chamber with the appropriate buffer solution.
2. Place the gel cassette into the buffer chamber, ensuring that the electrodes are fully submerged in the buffer solution.
3. Connect the power supply to the electrodes and turn on the electrophoresis machine.
4. Allow the electrophoresis to proceed for the recommended time and voltage, following the protocol of the experiment.
5. Turn off the power supply and remove the gel cassette from the buffer chamber.

Step 3: Staining and Visualization

1. Stain the gel using a suitable staining solution.
2. Visualize the separated molecules using an appropriate imaging system.

Step 4: Cleaning and Maintenance

1. After completing the electrophoresis, clean the gel tray or cassette with a suitable cleaning solution or distilled water.
2. Store the electrophoresis machine in a clean and dry location, following the laboratory's storage protocols.
3. Follow any cleaning and maintenance protocols to ensure the longevity and accuracy of the electrophoresis machine

Administering first aid is an essential skill that can save lives and prevent further injury. Here are step-by-step instructions for administering first aid:

Step 1: Assess the Situation

1. Make sure the area is safe for you to approach.
2. Assess the situation and look for any potential hazards.
3. Determine the type and severity of the injury or illness.

Step 2: Provide Basic First Aid

1. Check for any signs of breathing, bleeding, or other life-threatening conditions.
2. If the person is not breathing, perform CPR.
3. Control any bleeding using direct pressure and elevation.
4. Stabilize any broken bones or dislocated joints.
5. Provide comfort and reassurance to the injured person.

Step 3: Monitor the Person

1. Monitor the person's vital signs, such as their breathing, pulse, and blood pressure.
2. Look for any changes in their condition.
3. If necessary, provide additional first aid as needed.

Step 4: Document the Incident

1. Document the incident and any first aid provided in a detailed and accurate manner.
2. Record the time, date, location, type of injury or illness, and any treatments provided.
3. Keep this documentation in a secure location, such as a medical file or first aid kit.

Step 5: Call for Help

1. If necessary, call emergency services or a medical professional for assistance.
2. Provide them with as much information as possible, including the type and severity of the injury or illness, your location, and any other relevant details.

Step 6: Follow Up

1. Follow up with the injured person and provide any additional assistance or support as needed.
2. Encourage them to seek medical attention if necessary.
3. Remember, administering first aid can be a life-saving skill, but it is important to seek professional medical assistance whenever necessary

Proper cleaning of glassware is essential in any laboratory setting to avoid cross-contamination and ensure accurate and reliable results. Here are step-by-step instructions for washing glassware:

Step 1: Preparation

1. Put on gloves and other personal protective equipment, as necessary.
2. Collect all the glassware that needs to be cleaned.
3. Check the glassware for any visible residues, such as chemicals or biological materials.

Step 2: Pre-rinsing

1. Rinse the glassware with water to remove any visible residues or debris.
2. If necessary, soak the glassware in a suitable cleaning solution to loosen any stubborn residues.

Step 3: Cleaning

1. Use a suitable detergent or cleaning solution to clean the glassware.
2. Use a brush or sponge to clean the interior and exterior of the glassware, paying particular attention to any hard-to-reach areas.
3. If necessary, use a pipette brush to clean the interior of pipettes and other narrow glassware.

Step 4: Rinsing

1. Rinse the glassware thoroughly with tap water to remove any detergent or cleaning solution.
2. Rinse the glassware with distilled or deionized water to avoid any contamination from tap water minerals or other impurities.
3. If necessary, rinse the glassware with a suitable solvent, such as acetone or ethanol, to remove any organic residues.

Step 5: Drying

1. Allow the glassware to air-dry in a clean and dry location, such as a drying rack or cabinet.
2. Alternatively, use a clean lint-free cloth or paper towel to dry the glassware.

Step 6: Storage

1. Once the glassware is completely dry, store it in a clean and dry location, following the laboratory's storage protocols.
2. Avoid storing glassware in direct sunlight or in locations with high humidity or temperature.

Standard Operating Procedure (SOP) for Incubator

An incubator is a temperature-controlled device used in laboratories for growing and maintaining cultures of microorganisms or for conducting other temperature-sensitive experiments. Here are detailed instructions for operating a typical incubator:

Step 1: Setup and Preparation

1. Place the incubator in a well-ventilated area, away from direct sunlight and other heat sources.
2. Ensure that the incubator is plugged into a reliable power source and turned on.
3. Adjust the temperature control knob or digital settings to the desired temperature for your specific experiment or culture.
4. Allow the incubator to reach the set temperature and stabilize for at least 30 minutes before proceeding.

Step 2: Loading the Incubator

1. Prepare the culture plates, flasks, or other containers containing the specimens or samples to be incubated, following appropriate protocols and guidelines.
2. Place the specimens or samples in the incubator, making sure they are properly labeled and positioned according to the experiment requirements.
3. Close the incubator door securely to maintain a stable temperature and prevent temperature fluctuations.

Step 3: Monitoring and Maintenance

1. Monitor the temperature inside the incubator regularly using the built-in thermometer or a calibrated external thermometer.
2. Check the humidity level inside the incubator, if applicable, and adjust as needed using a water pan or other humidity control methods.
3. Keep a record of the temperature, humidity, and other relevant parameters at regular intervals, as required by your experiment or laboratory protocols.
4. Regularly clean and disinfect the incubator, including the shelves, walls, and air vents, using appropriate cleaning agents and methods, following laboratory guidelines.

Step 4: Safety and Security

1. Follow all laboratory safety protocols and guidelines, including wearing appropriate personal protective equipment (PPE) when operating the incubator.
2. Avoid opening the incubator door frequently or for prolonged periods, as this can cause temperature fluctuations and affect the growth of cultures.
3. Do not overcrowd the incubator, as this can affect air circulation and temperature distribution.
4. Report any malfunction or abnormal conditions of the incubator to laboratory staff or maintenance personnel immediately.

Step 5: Shutdown and Cleanup

1. Before shutting down the incubator, ensure that all cultures or samples inside have been properly removed or transferred to appropriate storage.
2. Turn off the incubator and unplug it from the power source.
3. Clean and disinfect the interior and exterior of the incubator thoroughly, following laboratory guidelines.
4. Store any accessories or attachments properly, and close the incubator door securely.

Standard Operating Procedure (SOP) for Lux Meter

Lux meters are used to measure the intensity of light in a specific area. Here are step-by-step instructions for operating a lux meter:

Step 1: Preparation

1. Turn on the lux meter and allow it to warm up for at least 10 minutes.
2. Ensure that the lux meter is calibrated.
3. Select the appropriate measurement range on the lux meter, based on the intensity of light in the area.

Step 2: Measurement

1. Hold the lux meter in a vertical position, with the sensor facing upwards.
2. Place the sensor at the location where you want to measure the light intensity.
3. Read the measurement displayed on the lux meter, ensuring that the units of measurement are appropriate for your needs (usually lux or foot-candles).
4. Repeat the measurement in other locations as needed.

Step 3: Analysis and Recording

1. Analyze the measurement results, taking into account any relevant factors such as the location, time of day, and any other relevant conditions.
2. Record the measurement results in a suitable format, such as a laboratory notebook or computer spreadsheet.
3. Store the lux meter in a clean and dry location, following the laboratory's storage protocols.

Step 4: Cleaning and Maintenance

1. After completing the measurement, clean the sensor with a suitable cleaning solution or distilled water, following the manufacturer's instructions.
2. Follow appropriate cleaning and maintenance protocols to ensure the longevity and accuracy of the lux meter.

Standard Operating Procedure (SOP) for Microtome

A microtome is a laboratory instrument used to cut thin sections of tissue or other specimens for microscopic examination. Here are detailed instructions for operating a typical microtome:

Step 1: Setup and Preparation

1. Gather all the necessary equipment, including the microtome, appropriate specimen blocks, and a clean glass knife or disposable blade for cutting.
2. Ensure that the microtome is clean and in good working condition, following the manufacturer's instructions.
3. Prepare the specimen blocks by embedding the specimens in a suitable embedding medium, such as paraffin or resin, and allowing them to solidify.
4. Select the appropriate thickness for the desired sections, and adjust the microtome accordingly, following the manufacturer's instructions and any experimental protocols.

Step 2: Loading the Specimen

1. Open the microtome and carefully place the prepared specimen block on the microtome stage, securing it with the specimen clamp or holder.
2. Adjust the specimen block orientation, ensuring that the cutting surface is properly aligned with the microtome knife or blade for the desired sections.
3. Close the microtome, ensuring that the specimen block is securely held in place, and verify that the microtome is set to the desired cutting thickness and speed, following the manufacturer's instructions.

Step 3: Cutting Sections

1. Start the microtome, following the manufacturer's instructions, and begin cutting sections by turning the hand 0wheel or using the cutting lever to move the specimen block back and forth across the knife or blade.
2. Use a brush or a compressed air source to gently remove the cut sections from the knife or blade, and transfer them to a clean water bath or other suitable collection surface.
3. Repeat the cutting process, adjusting the thickness and speed as needed, until the desired number of sections has been obtained.
4. If necessary, adjust the cutting angle or other settings to obtain optimal results, following the manufacturer's instructions and any experimental protocols.

Step 4: Cleaning and Maintenance

1. After completing the cutting process, turn off the microtome and carefully clean the knife or blade, stage, and other surfaces with a clean, damp cloth or other suitable cleaning method.
2. Remove the specimen block from the microtome, following the manufacturer's instructions, and clean it thoroughly to remove any residual embedding medium or other debris.
3. Inspect the microtome for any damage or wear and report any issues to laboratory staff.
4. Store the microtome and other equipment in a clean and dry location, following the laboratory's storage protocols.
5. Follow any cleaning and maintenance protocols established by the laboratory or manufacturer to ensure the longevity and accuracy of the microtome.