LABORATORY MANAGEMENT POLICY

(Chapter - XIX, University Policies & Guidelines)

- *Rules & Regulations*
- *Safety Procedures & Precautions*
- *Standard Operating Procedure*
- *Calibration & Refurbishments*
- *Maintenance & Cleaning*

UNIVERSITY OF SCIENCE & TECHNOLOGY MEGHALAYA

Unveiling Excellence

LABOROTAORY MANAGEMENT POLICY

INDEX

DEPT. OF APPLIED BIOLOGY
LABORATORY INSTRUCTIONS AND SOP

DOs AND DON'Ts INSIDE A LABORATORY

1. ALWAYS WEAR LAB COAT (LAB COAT MUST BE OF UPTO KNEE LENGTH AND FULL SLEEVE).
2. ALWAYS WEAR SHOES WHILE WORKING IN A LABORATORY.
3. ALWAYS WEAR GLOVES WHILE IN A LABORATORY.
4. LONG HAIRS SHOULD BE TIED UP AND NAILS SHUOLD BE TRIMMED TO PULLOUT ACCIDENTS.
5. IN CASE OF USING MICROBES, FUMING SUBSTANCES, PLANT TISSUES CULTURE PRACTICALS, USE OF FACE-MASK IS NECESSARY.
6. IN CASE OF ACID SPILLING WASH WITH ENOUGH WATER UNTIL THE BURNING SENSATION SUBSIDES.
7. WASHING OF HANDS BEFORE AND AFTER PRACTICALS IS MUST.
8. MOBILES PHONES ARE STRICTLY PROHIBITED INSIDE LAB.
9. BAGS ARE TO BE KEPT OUTSIDE THE LABORATORY.
10. NO EATABLES ARE PERMITTED INSIDE THE LABORATORY.
11. NO EATING OF ANY **MOUTH FRESHNERS/GUTHKA/PAN MASALA/CHEWING GUM** INSIDE THE LAB. IF FOUND, FINE WILL BE IMPOSED.
12. FUMES EMITTING LIQUIDS TO BE HANDLED NEAR OPEN WINDOW. KEEP OF WHILE USING SUCH LIQUIDS. e.g. ACIDS.
13. HANDLE WITH CARE WHILE PIPETTING USING GLASS PIPETTES. NO MOUTH PIPETTING SHOULD BE DONE IN CASE OF CORROISIVE LIQUIDS.
14. NO SHOUTING/ LISTENING OF SONGS/ SINGING ETC IN THE LABORATORY.
15. ANY BREAKAGE OF ANY GLASSWARE BY ANY INDIVUAL WILL ATTRACT FINES AND MUST BE INFORMED IMMEDIATELY TO THE LAB ASSISTANT.
16. NO WRITINGS ON THE WALLS OF THE LABORATORY.
17. KEEP THE INSTRUMENTS/ GLASSWARES CLEAN AFTER USE.
18. AFTER THE PRACTICALS DEPOSIT EACH OF THE CHEMICALS/ GALSSWARES AND ANY OTHER ITEMS TO THE PERSOON CONCERNED.
19. IF YOU NEED ANY HELP ASK ANY TEACHER PRESENT IN THE LAB.

- **SAFETY REQUIREMENT**

20. FIRST AID KIT SHOULD BE PLACED IN THE LAB AND SHOULD KNOW ITS LOCATION.
21. FIRE EXTINGUISHERS SHOULD BE PROVIDED IN EACH LABORATORY

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT **Microscope**

MAKE & MODEL **Labvision Medstar**

Operating procedure

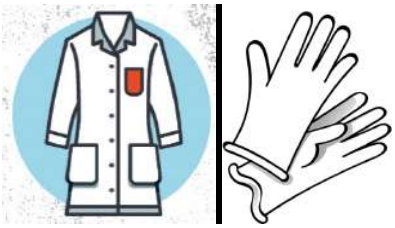
Set up and use of a compound light microscope

1. Read and be familiar with the user manual for your model of microscope.
2. Carry the microscope with two hands, one under the base and the other gripping the arm or frame.
3. Gently place the microscope on a flat, level surface and plug into a power source. Some microscopes have a built in light source but others have a mirror to focus natural light or an external light source.
4. With a built-in light source, turn on the light source and adjust the light setting so that it is not too bright by turning or sliding the brightness adjustment knob on the base.
5. 'If using an external light source direct the light via the mirror. Rotate the low power objective into position. Remove the eyepiece, look down the body tube and adjust the mirror and diaphragm setting so light is reflected up the tube and a circle of evenly illuminated light is visible in the field of view. Replace the eyepiece.
6. The iris diaphragm is located just above the light source on the bottom side of the stage.
7. Between the stage and the iris diaphragm is the condenser. The condenser further aids in the focusing of the light onto the specimen.
8. Adjust the stage down as low as possible with the coarse focus knob.
9. Begin by viewing the specimen with the lowest power objective lens in place and then increase to the higher power objective lenses.
10. Select the 4x scanning objective by rotating the nosepiece, ensuring it clicks into place.
11. Place a prepared slide onto the stage and hold it in place with the metal clips.
12. After placing the slide on the stage look at the objective lens and the stage from the side
13. Look in the eyepiece/s and slowly move the stage away from the objective lens with the coarse focusing knob. Stop when the image comes into view.
14. Use the fine focus to sharpen the image. Scan the slide, select the part of the specimen you are interested in and centre it in your field of view.
15. Adjust the sub-stage iris diaphragm to optimise the lighting.
16. Rotate in the low power 10x objective and refocus with the fine focus.
17. Repeat with the high power 40x objective, adjusting the iris diaphragm if required.
18. If you have a 100x oil immersion objective, you will need to first focus on the specimen with the 40x objective. Next rotate the nosepiece so that a midway position is obtained between the 40x objective and the 100x objective.
19. Sharpen the image with the fine focus only and adjust the light with the iris diaphragm if required.
20. When finished, lower the stage, rotate the low power objective (4x) into position and remove the slide.
21. Clean the oil off the slide and the objective when finished with lens tissue and lens cleaning fluid.
22. Turn off the light and at the main switch.
23. Report any problems to your teacher.
24. Cover the microscope with its dust cover.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	**P^H METER**
MAKE & MODEL	**Systronic**

Requirement:



Procedure:

1. Before use, ensure that the meter is being calibrated, to obtain more accurate measurements
2. Press the On/Off Key to switch on the meter, which will automatically enter into pH mode.
3. Submerge the pH electrode and the temperature probe into the sample to be tested and keep them close together, if automatic temperature compensation is desired.
4. Disconnect the temperature probe from the meter if manual temperature compensation is desired whenever the temperature of the sample to be tested is already known.
5. Press the RANGE Key until the display changes to temperature mode.
6. Adjust the displayed temperature by using the Up and Down Keys respectively.
7. Press the RANGE Key again until the display changes back to pH mode.
8. Submerge pH electrode into the sample to be tested.
9. Shake the sample briefly and wait for reading to stabilise before taking the reading.
10. Read off the displayed stable pH reading compensated for temperature.
11. Rinse off the pH electrode with some solution from the next sample if more than one sample is to be successively tested.

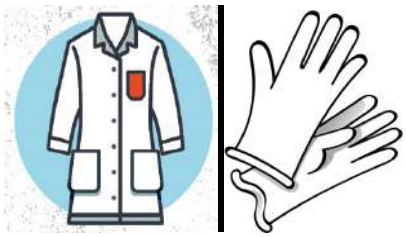
Measuring Temperature:

1. Press the On/Off Key to switch on the meter.
2. Press the RANGE Key until the display changes to temperature mode.
3. Dip the temperature probe into the sample.
4. Allow 1-2 minutes for the reading to stabilise.
5. Read off the displayed stable temperature reading.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	**Autoclave**
MAKE & MODEL	**NSW, India**

Requirement:



Procedure:

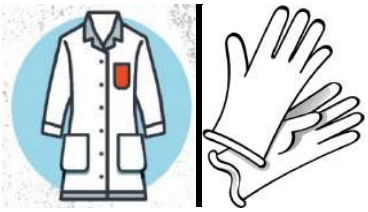
1. Verify that the door is latched firmly.
2. Do not attempt to open the door while the autoclave is still operating.
1. Unloading the Autoclave
2. Wear heat-insulating gloves, eye protection, lab coat, and closed-toe shoes.
3. Ensure that the cycle has completed and both temperature and pressure have returned to a safe range. Typically this means that the temperature is below 100C and the pressure is back to 0psi.
4. Unlatch the door slowly, allowing extra steam to escape. Once door is completely unlatched, carefully open the door no more than 1-2 inches. This will release the remaining steam upwards and allow pressure within liquids and containers to normalize.
5. Allow autoclaved load to stand for a few minutes in the chamber. This will allow steam to clear and trapped air to escape from hot liquids, reducing risk to the operator.
6. Do not agitate containers of super-heated liquids or remove caps before unloading. Do not agitate or remove caps until the liquids have cooled to a safe level.
7. Wearing heat-insulated gloves, remove items from the autoclave and place them on a stable structure to allow them to cool. This stable structure may be a water bath for liquids which need to remain molten.
8. Shut the autoclave door and partially latch if necessary to keep the door closed.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT **Gel Doc Unit**

MAKE & MODEL **GeNei**

Requirement:



Procedure:

1. Launch the software:

- Ensuring you are using an un-gloved hand, click the mouse to activate the monitor.
- Open the GelDoc software if it is not already open.
- On the menu bar, select 'File', toggle down to 'Acquire' and select
- 'GelDoc'.

2. Positioning the gel:

- Open the chamber door with the ungloved hand and with the gloved hand load the gel into the chamber. Centre the gel, using the monitor to assist in visualization.
- Close door and switch on the UV light.
- With an ungloved hand, adjust the focus, zoom and aperture on the camera to obtain the optimal image.
- In the GelDoc window, click 'Capture'. Select the hatched-box icon in this window and drag it to select the area of interest.
- On the menu bar, select 'Edit' and cursor down to 'Extract'. A new window will appear with the final picture. You may wish to adjust the image properties such as brightness and contrast.

3. Printing:

- On the menu bar, select 'File', cursor down to 'Video Print' and click to print.
- Close the windows containing the extracted and original images, Click 'Don't Save' in the pop-up dialog box.

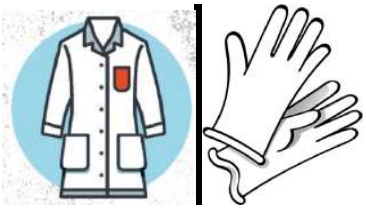
4. Closing the program:

- Turn off the UV light.
- With a gloved hand, remove your gel from the chamber and wipe down the glass surface of the GelDoc with a Kimwipe.
- Close the door to the chamber with the ungloved hand.
- Record your name and the number of photos taken in the log book.

NAME OF INSTRUMENT **Vacuum Freezer Dryer (Lyophilizer)**

MAKE & MODEL **Amketee India pvt**

Requirement:



Procedure:

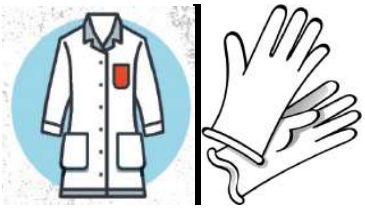
1. Do not use the freeze dryer unless an experienced user has shown you in detail how to use it. The use of the propane torch to constrict the ampoules is hazardous, and should be done under supervision the first time for new users.
2. Switch ON vacuum pump and allow it to operate (warm-up for 15 minutes) before starting any procedures. The lever opening the pump to the chamber remains closed during this time. CLOSED position is when the lever is pointing to the left and horizontal. OPEN is when pointing upward and vertical. The drain valve knob (lower left-hand side of machine) on the chamber should be screwed in to the CLOSED position
3. Turn ON freeze dryer machine (right-hand side). Press the left-hand (MODE) button to exit the tutorial (unless you want to read it!). Press the MODE button on the left of the display. Three options appear on screen (1) Freezing mode; (2) Warm up pump; (3) Main Drying. If the pump has been pre-warmed for 15 mins then scroll to "Freezing" mode and press right hand button to <ENTER>. The display will start counting Time and also show the condenser coil temperature, which should go down to – 55 ^{0}C (this takes about 11 mins).
4. Once coil is chilled, you can (a) place your samples inside the chamber; (b) place your frozen flask samples onto the ports around the chamber or (c) add your small ampoule samples onto the "Christmas tree" if drying bacteria etc.
5. OPEN the lever on the vacuum pump to the vertical position. This will create a vacuum in the chamber. Open the required ports to your flasks if using those. This "Freezing" mode phase can be allowed to continue for 20-30 mins. to effect the initial freezing of small samples if they haven't already been frozen, or to maintain a frozen larger sample in a frozen state until the initial drying has occurred.
6. After the initial freezing phase, press the left-hand (MODE) button and a message will come up saying "Continue with phase", press right hand button to <ENTER>. The menu will show the next phase - scroll to Main Drying and press <ENTER> again to confirm. Drying can be continued until you are satisfied your sample is completely dry - see p21-22 of the manual for advice.
7. At the end of the run, turn the lever on the pump off (return to left facing horizontal position)
8. Note - it is very important that the pump is not turned off whilst a vacuum still exists in the chamber as it will suck the oil out of the pump!
9. Press the left-hand (MODE) button to bring up Standby mode - press <ENTER> to confirm. The machine will turn off the vacuum-freezing coil. Open the drain valve (lower left-hand side of machine) to vent the vacuum. A tube should be connected to allow the defrosted liquid to drain any condensate into a beaker.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT **Bacteriological Incubator**

MAKE & MODEL **Yorco, India**

Requirement:



Procedure:

1. Ensure that the incubator is properly connected to the power supply. Switch on the main.
2. Turn on the red colour power knob towards 0-1.
3. Turn on the cooling knob towards 0-1.
4. To set the incubator at 22°C , set the lower temperature 21 OC by pressing the 'SET POINT -1' and simultaneously adjust the temperature with the help of screw of SET and RST by screw driver.
5. Set the higher temperature 23 OC by pressing the 'SET POINT -2' and simultaneously adjust the temperature with the help of screw of SET and RST by screw driver.
6. In the same manner the incubator can be set to 37°, 44° and 55°C whenever required by setting the lower temperature to 36°,43° and 54° C respectively and by setting the higher temperature to 38°,45° and 56° C respectively.
7. Record the temperature twice daily. *i.e.* in the morning and in the evening. The temperature should not differ ±2°C from the set temperature.

Trouble shooting problems and remedial action:

1. The temperature display is not glowing. Check for power supply and proper electrical connections of instruments with power point.
2. Temperature is not even in the incubator. The air circulating fan may not be functioning. Check for it.

Report any discrepancy observed during operation or temperature monitoring to Q.C. Executive and notify the defect to Maintenance Department.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT UV-Visible Spectrophotometer

MAKE & MODEL Thermo Scientific Genesys

Requirement:

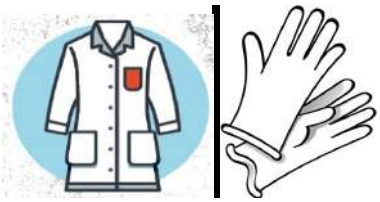
Procedure:

1. Turn on the spectrophotometer. The power switch is located on the back of the machine, lower left side. The spectrophotometer will automatically perform some diagnostics, and requires a 30 min warm up before measurements.
2. Press the button “Set nm” (located below the LCD display) to select the wavelength, enter the wavelength and press “Set nm” button again.
3. Select the measurement type as absorbance or transmittance by pressing the “change mode” button.
4. Open the chamber and insert your cuvette(s) into one of the cells, making sure that the optically clear side of the cuvette will receive light from the spectrophotometer’s lamp and that the cuvette is sitting on the bottom of the cell. Blank (reference) sample should be placed in B.
5. Close the chamber and read the absorbance / transmittance. As you press (B, 1, 2, 3, 4, 5) buttons, the corresponding sample will be measured. Record your data.
   - For BLANK press MEASURE BLANK, then MEASURE STANDARD and press ENTER button.
   - For SAMPLE press MEASURE STANDARD and press ENTER button.
6. When finished, shut off the machine using the same power switch on the back.

NAME OF INSTRUMENT Thermo Cycler (PCR Machine)

MAKE & MODEL Eppendorf

Requirement:



PROCEDURE

1. Set up the reaction wearing gloves at all times and label the lids of the eppendorf, as anything written on the sides will not remain after being in the PCR machine.
2. Take care to avoid carry over between tubes or contamination of stock Note: Include the following control reactions for each DNA template. (i) Positive DNA control if appropriate (ii) Negative DNA control if appropriate (iii) No template control using sterile water instead of DNA
3. A typical reaction is as follows:

Sterile pure water 42µl
10 x AJ buffer 5µl
Primer 1 (Forward) 10pm/µl 1µl Primer 2 (Reverse) 10pm/µl 1µl
Template DNA or cDNA 1µl 50µl

4. Spin the tubes briefly in a microfuge
5. Place the eppendorf in the thermal cycler and carry out an initial denaturation at 98°C for 3 minutes.
6. Cool the PCR machine to 80°C (or annealing temp) and pause it at this temperature Add 1 unit of Taq polymerase (1µl of Taq diluted 1:5 or 2µl of a 1:10 dilution in 1 x AJ buffer)
7. Re-start the machine and amplify the DNA for between 25 - 40 cycles.

Parameters for a typical cycle might be:

94°C 30 sec.Denaturation
60°C 30 sec. Annealing of primers
72°C 30 sec. Extension of sequences

8. Remove tubes from Thermal cycler and analyse the PCR products on a 3% HGT agarose gel.

The following precautions must be observed to minimise the risk of cross contamination when setting up a PCR reaction.

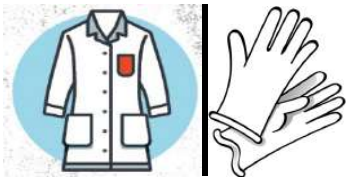
- PCR should ideally be performed in a dedicated ‘clean’ area which is free from other work involving DNA.
- All stocks of Gilson tips, eppendorfs, etc. to be used should be nuclease-free, and stored in a dust free environment. The use of filter tips is advisable.
- Gilson pipettes designated solely for PCR should be used to set up the reaction.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Centrifuge (Mini Spin)

MAKE & MODEL Eppendorf

Requirement:



Centrifuge: A device in which materials of different densities are separated by rotation at various speeds about a fixed, central point, by way of centrifugal force. The denser particles tend to move along the length of the tube to a greater radius of rotation, displacing the lighter particles to the other end.

Rotor: The rotating part of the centrifuge which holds the samples.

Procedure
Operation

1. Turn on the mains switch.
2. Press *Open* to open lid.
3. Load the rotor symetrically.
4. Fasten the rotor lid and close the centrifuge lid.
5. Press the left *Up* and *Down* arrow keys to select duration of centrifuge spin between 15 seconds and 30 minutes.
6. Press the right *Up* and *Down* arrow keys to select the speed of centrifuge rotation between 800rpm and 13400rpm.
7. Press *Start/Stop* key to start the run.
8. Press *Start/Stop* key to end the run prematurely.
9. Press the left and right *Up* and *Down* arrow keys respectively to change the duration of centrifuge spin and rotational speed during a centrifuge run.
10. Hold the *Short Spin* key down for as long as needed to perform short spin centrifugation for a maximum speed of 13,400 rpm.
11. Wait until the lid opens automatically after the run to remove samples.

Maintenance

1. Clean the outside of the centrifuge regularly with a moist cloth.
2. Disconnect the centrifuge from the mains supply to remove the rotor to clean separately.
3. Use neutral agents for cleaning purposes and use alcohol-based disinfectants for disinfection purposes.

4. Remove any residues present in the bores of the rotor using a bottle brush and a hand-hot cleaning solution. Rinse well. Leave bores facing downwards on a cloth to allow them to dry.
5. Check rotor and rotor bores regularly for deposits or damage.
6. Allow the rotor to accelerate once to the maximum speed after cleaning.

Precautions

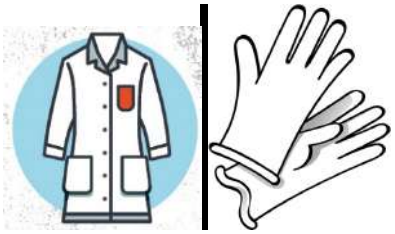
1. Do not position objects that could cause damage to centrifuge operation in the space around it.
2. Ensure that the rotor and rotor lid are always securely fastened. If the centrifuge makes unusual noices when started, switch device off by pressing *Stop* and fasten rotor lid tightly.
3. Load rotor symmetrically to reduce wear on the drive and to cut running noise.
4. If an odd number of samples is present, use water samples to balance rotor out.
5. Do not use centrifuge if it has not been correctly installed or repaired.
6. Do not operate centrifuge in a hazardous or flammable environment.
7. Do not use centrifuge for explosive or highly reactive substances.
8. Clean centrifuge properly if you spill toxic or radioactive substances in the rotor or rotor chamber.
9. Inspect microcentrifuge tubes for material damage prior to centrifugation. Do not centrifuge damaged tubes.
10. Always use microcentrifuge tubes of the same type during a run.
11. Close the microcentrifuge tube lids tightly before centrifugation.
12. Do not exceed a liquid density of 1.2g/ml at the maximum rotational speed.
13. To prevent damage caused by condensation, allow centrifuge to warm up in lab for at least three hours before plugging it in.
14. Avoid damage to rotor or rotor lids caused by aggressive chemicals. Clean rotor immediately using a neutral cleaning liquid if contaminated by an aggressive chemical.
15. Do not use damaged rotors.
16. Do not move the centrifuge during the run.
17. After a run, do not open the lid of the centrifuge since it opens automatically.
18. Disconnect the centrifuge from the mains supply in case of power failure. Wait until the rotor has come to a standstill. Lift up the centrifuge and insert a pen into the opening in the ground plate to move the disc in the direction of the arrow. Lift the centrifuge from the edges only since the underside may be very hot.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Cooling Centrifuge

MAKE & MODEL Eppendorf

Requirement:



Procedure

1. Inspect the rotor, buckets, adaptors and tubes for cracks or other signs of wear before use.
   a) Damaged tubes MUST NOT be used because they will result in sample loss and damage to the centrifuge.
   b) The rotor and buckets have an operating life of seven years and may not be safe to use after this period.
2. Check the rotor and buckets before using them to make sure they are clean.
3. If the centrifuge was used within the last 8 hours, and left on with the lid closed, the temperature will be at the set value.
4. If the centrifuge is off, turn on the main power switch. The nominal values of the last run are displayed.
   - If you need to rapidly cool the centrifuge, you can use the fast temp function:

With the buckets empty, press the fast temp button. This starts a run optimized for maximum cooling rate. The centrifuge will automatically stop the run when the target temperature has been attained.

5. Load the rotor symmetrically.

If your tubes are longer than the depth of the bucket, manually swing the bucket to confirm that it can swing freely.

6. Close the centrifuge lid. The Open key lights blue.
7. If you have previously saved a program, press the prog button and select the desired program. To set up a run or create a new program:

a. Press the temp button and set the temp for the run (between –9°C to +40°C).
   a) Press the speed button and use the arrows to select the desired speed (pressing the speed button more than once alternates between rpm, rcf, and rotor radius. Rotor radius only needs to be entered for a new rotor, and it is used to convert rpm to rcf for that rotor).
   b) Press the time button and set the time for the run.
      i. To set the centrifuge to run continuously, set the time above 99 minutes, or below 1 minute ("oo" indicates continuous operation).

ii. The time button is also used to adjust the braking and acceleration speeds: For example, "9" represents the fastest acceleration and breaking, but may not be suitable for unstable separations.

iii. If you want the centrifuge to start counting time only when the rotor has reached the specified rotational speed, open the lid and hold down the start/stop button for longer than 4 seconds. The upper blue triangle in the pictogram will be illuminated to indicate that the time will only start to count down after the rotor has reached full speed.

d. To save these settings as a program, press the program key twice to display the next available program number, then hold down the program key for two seconds to save the parameters.

8. To run a very short spin, press the short button and hold down for as long as you want the run to last. Otherwise, press Start:

a. *Rotor recognition occurs at 200-700 rev/min and the device then accelerates to the set speed.*

b. During the run, the rotational speed of the rotor or the appropriate rcf value, the sample temperature and the remaining spin time in minutes are displayed. The last minute is counted down in seconds.

c. During the run, all parameters can be modified (i.e. the time can be changed by pressing the time key and using the arrows to adjust. The time already elapsed is taken into account by the centrifuge).

d. Once the set temperature value has been reached, a deviation greater than ± 3 °C is indicated by a flashing temperature display.

If the temperature deviates by more than 5 °C, a periodic warning signal can be heard and the centrifuge switches itself off.

9. After the end of a run or after a run has been interrupted by pressing the Stop key, the rotor is braked and brought to a standstill. During the braking process, the time display flashes and the elapsed spin time is displayed.

10. When the lamp in the Open key lights up, the lid can be unlocked by pressing the key.

11. Unload your samples, and check for any spills or broken tubes.

12. Empty and clean the tray for condensation water (on the right at the bottom of the device).

13. Wipe out the inside of the centrifuge, the buckets, and the adaptors:

a. Any condensate or spills inside of the centrifuge chamber must be wiped up.

b. Metal rotors in contact with moisture for extended periods of time may result in corrosion and equipment damage. It is important that the rotor is left clean and dry after use. Dry the rotor thoroughly.

i. If a spill occurred, the rotor, buckets and adaptors should be cleaned with mild soap and water (no abrasives) and a proper rotor cleaning brush (the ends are protected to reduce the chance of scratching the rotor).

ii. If spilled material is left in the buckets, it could imbalance the rotor on the next run, spread material throughout the centrifuge, or cause the rotor itself to corrode.

iii. After the rotor, buckets and adaptors have been cleaned and well rinsed with DI water, ensure that they are dried completely before putting back in the centrifuge.

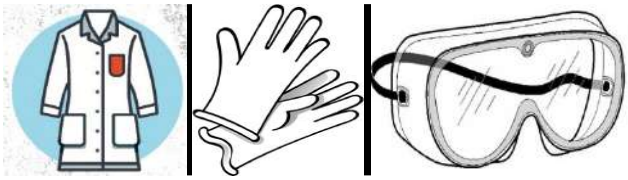
14. If you will not be using the centrifuge within the next 8 hrs, switch the instrument off and leave the lid open.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Transilluminator

MAKE & MODEL GeNei

Requirement:



UV transilluminator is a basic device for visualizing fluorescence-stained gels. H/L dual intensity offers best conditions for both gel excision and gel-visualizing applications. The stainless steel frame prevents any possible UV light leakage and the UV-blocking cover fully protects user from UV light exposure during operation.

Procedure
Operation
1. The power of the unit should be turned off.
2. Open the UV-blocking cover to desired angle.
3. Place the sample on the filter surface.
4. Close the UV-blocking cover or make sure people surrounded are under proper protection.
5. Press the switch “power ON/OFF” to turn on the unit. The tubes should become energized and emit a steady glow of light. The light may initially flicker, especially if the lamp is cold, but should stabilize after a few seconds.
6. Press “high/low switch” for preferred intensity to visualize. If you need high intensity of UV radiation, then press the switch to “high” for high intensity. (Note: Do not press the switch subito up and down.)
7. Visualize or capture image by imaging system or any camera available. 8. Turn off the unit before remove the sample.
9. Clean the sample touched surface with soft tissue.

Care and Maintenance
Sample touched surface of UV transilluminator should be cleaned by moisten soft tissues after every usage to avoid all possible contaminations and damages of instruments. Do not use abrasive detergent, it could damage the filter and decrease its lifetime.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Hot Air Oven

MAKE & MODEL Yorco, India

Requirement:

Procedure:
1. Connect the power supply.
2. Switch "ON" the main power supply and instrument mains.

Temperature setting
3. Press SET POINT (x/w) key to set the required temperature. press ↑ to increase the temperature and ↓ to reduce the temperature
4. The temp. Sensor will maintain the set temp which is indicated by the blinking of set temp on the display screen.
5. The duration of time can also be adjusted using the time adjustment knob
6. After use, SWITCH OFF the power supply.

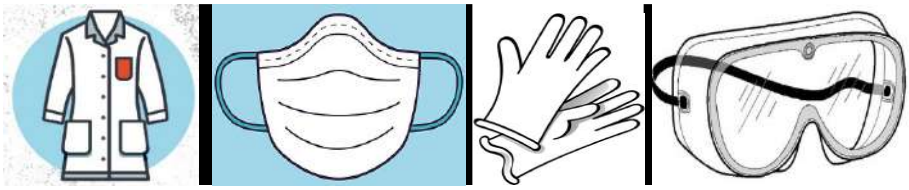
Cleaning:
- Wipe the surface, walls, top, bottom and trays of the oven with dry lint free cloth on daily basis so that there will be no dust particles in the oven.
- Wipe all the parts and outer surface of the Oven with wet lint free cloth soaked in purified water, on weekly basis and fill the weekly cleaning record.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Sonicator

MAKE & MODEL Revotek

Requirement:



The sonicator makes use of high-energy sound waves to cause lysis of cell cultures as well as homogenization of other solutions. The Primary Hazard risk is damage to the ears caused by exposure to high-frequency sound waves. Additionally, the sonicator can cause local heating of the solution, which could result in a sudden splashing of the sonicated solution.

Procedure

1) Close all doors that provide access to the room housing the sonicator.
2) Use Ear protection, found in labeled drawer, in addition to standard PPE.
3) Ensure that anyone in the sonicator room has ear protection, if not, ask them to get some or to leave the room.
4) To change the tip, use the special wrenches provided in the sonicator draw. Ensure that the new tip is securely fastened to the sonicator head.
Never operate the sonicator without a tip or cap - ***there should never be visible screw threads at the tip***
5) Place sonicator into solution. It is highly suggested that the solution be kept on ice during sonication to keep temperature low and prevent spashing.
6) Run sonication according to personal experimental protocols; then shut off instrument
7) Wipe any solution from sonicator tip and dispose of towels as chemical nature demands.
8) Wipe sonicator tip with towels dampened with clean water, followed by towels dampened by 20% EtOH.
9) Return ear protection to proper place, and reopen doors to the room.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Laminar air Flow Chamber

MAKE & MODEL HiTech

Requirement:

Airflow which is linear and positive up to working surfaces and thus prevents contamination of surrounding viable/ non-viable particulate matter in aseptic handling.

Procedure

Cleaning of Laminar Air Flow

1. First of all, Turn OFF the switch of the Air Flow and UV of LAF unit (if ON).
2. Then clean properly the working chamber from ceiling, followed by side glass and then the platform of the chamber with 70% IPA.
3. After that spray 70% IPA and switch off the visible light and then switch ON the UV light till to start the next operation.
4. Finally Routine culture handling shall perform at the end of the Sample testing only.

Laminar Air Flow Operation

1. Switch ON the mains.
2. Ensure that the manometer is showing Zero reading before starting.
3. Turn the switch of the Air Flow to ON position. Ensure that the differential pressure is within the limit of 8 to 15 mm of water and record the observation in Annexure-2.
4. Turn the switch of the UV lights to ON position.
5. After 30 minutes switch OFF the UV and switch ON the Visible light.
6. Now perform the activities.

Maintenance

Pre-Filter Cleaning of Laminar Air Flow

1. First of all, Switch ‘OFF’ the mains of LAF, loosen the bolts properly and take out the Prefilter slowly, without any jerks from the LAF.
2. Then Shift the filter to wash area outside microbiology analysis room where cleaning is to be done.
3. Ensure the left out opening of the Prefilter on the LAF unit shall covered with butter paper in order to prevent dust as well as the outside air moving inside the LAF unit.
4. First de-dust the filter properly with the help of dry, oil free compressed air. The compressed air shall be forced properly to prefilter of LAF otherwise it will damage the filter.

5. After dedusting, clean the prefilter properly 2 -3 times with Purified water. Allow all the water to drain completely after water cleaning.
6. Then dry the prefilter after proper draining in a clean dry environment free from the dust; otherwise the chances of contamination in the sterile environment may arise or it may decrease the efficiency of the prefilter. Do not dry the prefilter in an open environment.
7. Spray 70% IPA solution filtered through 0.45 m filter and mop SS attachment of the prefilter properly before transferring inside the microbiology analysis area.
8. Affix the cleaned prefilter properly in appropriate place by removing the butter paper cover and tighten the bolts properly.

Differential Pressure Check in Laminar Air Flow

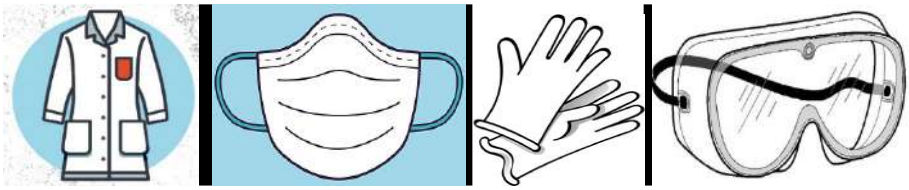
1. Then Place the prefilter at its position. Switch on the Laminar Air Flow (LAF) unit. Check the differential pressure is in between 8 to 15 mm of water gauge.
2. If pressure reading on manometer is not achieved, put a status label 'Under Maintenance' & intimate the Maintenance Department for necessary action.
3. Prefilter of the Laminar Air Flow (LAF) benches shall clean once in three months In order to retain the efficiency of the HEPA filter and proper working of LAF.
4. After the Prefilter is fixed, the area shall clean properly followed by fogging as per SOP of "Fumigation of Microbiology" before using the instrument as well as the area for operation.
5. Cleaning record is to maintain as per Annexure-1.
6. Clean the Pre filter at the frequency of 3 months ± 7 days.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Microwave Oven

MAKE & MODEL LG

Requirement:



Procedure

1. Switch on instrument
2. Prepare sample (as per application)
3. Place sample vessel inside instrument cavity on turntable

4. Program microwave intensity and time or Select desired programme
5. Press green key to run the programme
6. Stop oven manually or wait until time program is ended.
7. Open the door and take out sample vessel

Safe operation and precautions

1. Never use the microwave to heat food for human consumption.
2. Do not operate the oven if it is damaged. The door must close properly and there must be no damage to the door seals, hinges, and latches.
3. Do not heat combustible, flammable, or radioactive materials in the oven, or solvents with low boiling points, or volatile hazardous chemicals.
4. Do not heat sealed containers, as they may explode. Containers must have their tops/caps/closures fully loosened. Avoid standing right in front of the microwave during use, in case there is an explosion. But stay nearby, in case there is a problem.
5. To avoid a pressure build-up, do not heat frozen solutions unless the radius of the frozen material is less than the radius of the container opening.
6. Care must be taken when heating solidified agar/agarose. Either chop up the material first with a spatula, or heat at a maximum of 40% power until the radius of the solid material is less than the radius of the container opening. The goal is to prevent boiling until there is a route for releasing pressure.
7. Do not microwave any aluminium foil or metal container, utensil, or object, including those with a metallic trim.
8. Be careful when agitating liquids, as these may be superheated and boil once moved.
9. Clean up any spills, including materials on the walls of the chamber.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Weighing Balance

MAKE & MODEL Kern

Requirement:

Procedure

Operation

1. Check whether the sensitivity of the balance is appropriate for the amount of material to be weighed.
2. Zero the balance before use.

3. Put material to be weighed in a suitable container or on weighing paper, never directly on the pan of the balance.
4. Determine the mass of the weighing container or paper and then press tear to deduct the weight of the paper or container
5. Place the material to be weighed in the container or on the weighing paper in the middle of the pan to avoid corner-load error.
6. Note the mass of the substance being weighed from the screen of the balance.

Maintenance

1. Clean the balance with a soft, clean brush after use.
2. Disinfect balance pans and the working area with 70% ethanol.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Vortex Mixture

MAKE & MODEL GeNei

Requirement:

Procedure

Installation

1. Place on a level surface and plug cord into mains supply.
2. Place desired attachment onto the shaft and rotate until the 'flats' align.
3. Press the attachment down firmly until it snaps into place.
4. Grasp and pull straight up the installed attachment until it is released from the shaft if another type of attachment needs to be used.

Operation

Continuous Operation

1. Push switch to the 'ON' position.
2. Turn speed control knob to setting No.3 on the dial.
3. Observe that the attachment is immediately set in motion.
4. Place the sample tube on top of the attachment and keep steady.
5. Vary the speed on the dial and/or the angle of contact and pressure against the mixing attachment to achieve the desired mix.
6. Return switch to the 'OFF' position once finished.

Intermittent Operation

1. Push switch to the 'TOUCH' position.
2. Turn speed control knob to setting No.3 on the dial.
3. Touch the sample tube with the attachment to observe motion and keep steady.
4. Vary the speed on the dial and/or the angle of contact and pressure against the mixing attachment to achieve the desired mix.
5. Return switch to the 'OFF' position once finished.

Maintenance

1. Unplug the mixer from its power supply before attempting any cleaning measures.
2. Keep the unit clean by immediately blotting any spills.
3. Use a moistened cloth or sponge with a mild detergent to clean the outside surface.
4. Replace rubber attachments with new ones when these show progressive signs of wear.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Magnetic Stirrer

MAKE & MODEL GeNei/Matrix/SPINOT

Requirement:

Magnetic Stirrer is device used to thoroughly mix liquid materials. It consists of a bar magnet attached to a shaft of an electric motor and a small magnet that is placed in the liquid to be stirred. When the motor is activated, the attached magnet starts to rotate to set the small magnet in the liquid which in turn causes this liquid to be stirred.

Procedure

Operation

1. Place the magnetic stirrer on a stable well-levelled surface.
2. Place the stir bar at the bottom of a glass container.
3. Fill the glass container with the liquid to be stirred.
4. Plug the mains cable into a suitably earthed socket.
5. Check that the speed control knob is completely turned anticlockwise.
6. Place the glass container on the centre of the magnetic stirrer.
7. Press the On/Off switch to turn the magnetic stirrer On. The switch will light green.

8. Adjust the speed control knob to a low stirring rate.
9. Continue to adjust the speed control knob until the desired stirring speed is achieved.
10. Wait until the liquid is properly mixed.
11. Completely turn the speed control knob anticlockwise.
12. Press the On/Off switch to turn the magnetic stirrer Off.
13. Manipulate another stir bar from the outside of the glass container to remove the immersed stir bar.

Maintenance

1. Thoroughly wash the stir bar with distilled water after each application.
2. Store stir bars in pairs to maintain their magnetic strength and increase their life span

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Serological Water Bath

MAKE & MODEL NSW, India

Requirement:

Procedure:

1. Connect the power supply.
2. Ensure the water level in water bath is sufficient to pour the heating element.
3. Switch "ON" the main power supply and instrument mains. Temperature setting
Glowing of Red lamp indicate mains "ON" & Glowing of yellow lamp indicate heater "ON"
4. Press SET key to set the required temperature. press ↑ to increase the temperature and ↓ to reduce the temperature
5. The temp. sensor will maintain the set temp. during use of water bath.
6. Switch "OFF" the instrument mains & main power supply after use.

Maintenance

1. Always ensure platform & surrounding are dry.
2. Use only Purified water to fill water bath.
3. Always. Switch "OFF" the mains on completion of water bath use.
4. Do not disturb the capillary (Temp. Sensor) located near the heater.

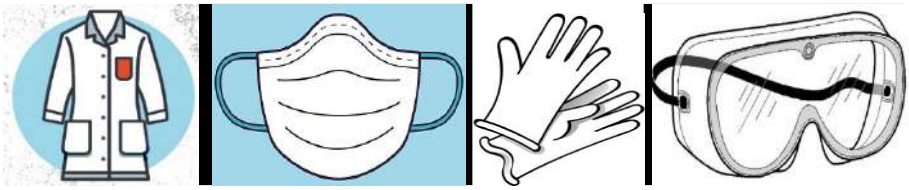
5. DO NOT add too much water, so as not to overflow during water is boiling.
6. After used the water bath, you should drain away water in time, clean the working chamber, so as to extend life span of instrument

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Gel Electrophoresis Apparatus

MAKE & MODEL GeNei

Requirement:



Pre-Operation

1. Select a good location for the placement and use of the equipment. Place the unit on the laboratory bench in such a way that the power supply (on/off switch) is easy to reach, so it is not necessary to reach across the apparatus, and the power-indicator light is easily seen.
2. Inspect the apparatus to be used. Examine the insulation on the high voltage leads for signs of deterioration (e.g., exposed wires, cracks or breaks, etc.) Check the buffer tanks for cracks or leaks, and missing covers.
3. Ensure that all switches, lights, and all safety interlock features are in proper working condition and that "Danger-High Voltage" warning signs are in place on the power supply and buffer tanks.
4. Make sure adequate clearance is established around the apparatus. Never allow the leads to dangle below the laboratory bench.

Operation

1. Don all appropriate personal protective equipment (gloves, laboratory coat, and eye protection).
2. Be aware that high voltage surges can occur when the apparatus is first turned on, even if the voltage is set to zer.
3. Changes in load, equipment failure, or power surges could raise the voltage at any time.
4. Make sure that the power is off before connecting the electrical leads. Connect both supply leads at the same time (to prevent one lead from being live in your hand) to the power supply before turning on the power supply. Otherwise, connect one lead at a time using one hand only.
5. Ensure that your gloved hands are dry while connecting leads. A thin film of moisture can act as a good conductor of electricity.

6. If the electrophoresis buffer (the conductive fluid) is spilled or is leaking from the gel box, stop the run, turn off the equipment, clean up the bench top and inspect the device immediately before proceeding.
7. Never open the gel box lid or reach inside the gel box until the power has been turned off. Do not rely on safety interlocks, as they may fail.

Post-Operation

1. Turn off the main power supply switch and wait 15 seconds before removing the lid and/or making any disconnection or connections. This ensures proper time was allowed to ensure complete voltage discharge.
2. Properly dispose of the conductive fluid and gels.

Hazards of Gels

1. Ethidium Bromide, commonly used to visualize nucleic acid, is a potent mutagen and should be handled with caution, even when mixed in the gel. Ethidium Bromide can be absorbed through the skin so it is also important to avoid any direct contact with the chemical.
2. Various catalysts, denaturants, stains and solubilizing agents contain a variety of chemicals, including formamide, phenol and acrylamide. This can result in unforeseen results. For example, a Canadian university analyzed agarose gels and found heavy metals, even though no metals or metal-containing reagents were used in the gel preparation. Presumably, the metals leached from the electrical contacts while the electrophoresis took place.
3. Acrylamide is a potent nerve toxin in its unpolymerized state and poses significant hazards. Although it is less toxic when polymerized, when making gels, the polymerization process is never fully complete and small amounts of acrylamide monomer are always present.

- Handle gels with caution, wear gloves and wash hands often.
- Measure, mix and handle all hazardous powdered chemicals or gel prep mixtures with hazardous components in the fume hood (e. g., acrylamide monomer, ethidium bromide, phenol, ammonium persulfate and formaldehyde).
- Purchase pre-made gels or pre-mixed acrylamide and ethidium bromide solutions instead of making your own.
- Consider using ethidium bromide substitutes.
- Always review the material safety data sheet and other sources of hazard information prior to working with any hazardous material.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Hot Plate

MAKE & MODEL Yona, India

Requirement:

Procedure
Operation

1. Place the sample vessel on the hot plate so that it is centred, where practical. For hot plates with multiple heating elements, centre the vessel over a heating element, where practical.
2. Turn the instrument on and set the thermostat to the desired setting (as specified in the study plan). Refer to the instrument's instruction manual for instrument specific procedures.
3. Allow around 10 minutes for hot plate and liquid temperatures to stabilize; adjust the temperature by adjusting the thermostat.
4. When heating is complete, turn the unit off.

Maintenance

1. Hot plate should be used on level surfaces.
2. If hazardous vapours will not be produced, hot plates should be in an area free of drafts to ensure heating efficiency.
3. Keep the top surface of the hot plate clean. Use a non-abrasive cleaner to clean the surface and the outside of the unit.
4. Replace the top surface if damaged.
5. Do not use metal foil on hot plates.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Orbital shaker Incubator

MAKE & MODEL Ikon Instruments

Requirement:

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.

Pre-Analysis

1. Make sure you have your required safety equipment of glasses, closed toe shoes, gloves, and laboratory coat Check the machine for any previous samples left inside.
2. Remove any dust or other foreign objects from the incubator platform with a soft towel or cloth.
3. Make sure the machine is plugged in. Equipment Operation Loading the Shaker
4. Put your sample material in an acceptable container with a lid.
5. Gently press the container in one of the spring housings until it is securely in place.

Shaker operation

1. Close the lid of the incubator and turn on the machine using the power switch to the right hand side. The LED display will momentarily show the model number. (*the shaker will not operate of the lid is open*) Once the machine is powered on, the incubator may start running. Pressing the start/stop button will cause the shaking to stop.
2. Press the select button until the RPM indicator is illuminated on the left hand side of the control panel.
3. Use the arrow keys to set the RPM of the shaker. A value from 50 to 400 RPM is available. The number will set when no buttons are pressed.
4. Press the select key until the ºC INDICATOR illuminates.
5. Set the temperature using the arrow keys. Temperature range is from 4º to 60ºC
6. Press the select key until the **hrs. INDICATOR** is illuminated.
7. Use the arrow keys to set the TIME of the shaker. This can be a value from .1 to 99.9. The number will set when no buttons are pressed. If a continuous run time is desired, simply press the start stop button.
8. Press the START/STOP key. The shaker will start in untimed mode.
9. Press the START/STOP key again. The shaker will stop and the display will read OFF.

10. Press the START/STOP key a third time; the time indicator will light and the shaker will now start the timed run.
11. The machine will come to a stop once the timed run has ended. If running in untimed mode, the START/STOP key can be pressed at any desired time.

Machine Shutdown

1. Make sure the machine has come to a complete stop and open the lid.
2. Remove any samples you need. Use a hot glove if high temperatures were set.
3. Turn off the power by flipping the switch on the right side of the machine.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Digital Colony Counter

MAKE & MODEL Yorco/LabFit

Requirement:

The colony counter helps the operator to perform the manual counting of the bacteriological colonies in two ways:

1. By making use of a good illumination (transmitted or reflected). The image of the Petri- dishes are shown perfectly.
2. Using an electronic counter which is activated with a soft touch of the pointer, without rebounds, the analyst does not have to memorize the number of colonies already counted.

Procedure
Operation

1. Turn on the electric power to light the LED and fluorescent lamp.
2. Place the updown Petri dish on the surface of the counter by adjusting the dish holder.
3. Adjust the focusing arm with the lens to the desired angle, if small colonies are to be counted.
4. Begin counting by touching the Petri dish with the marking pen. Every time a colony is marked, the electronic colony counter pen will register the count.
5. If the colonies are numerous and evenly distributed on the agar surface, it is possible to reduce the time and to count just to opposite segments of the plate and then calculate the total number of the cfu (multiplying for the number of segments).

6. When the counting of the Petri dish is completed, take note of the counted number in the report paper and replace the Petri dish with the next one.
7. At the end of activity, turn off the unit.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Ice Flaking Machine

MAKE & MODEL Marco Scientific Works

Requirement:

Procedure

1. Connect the machine directly to the mains electricity and water supply.
   (*The machine should be unobstructed to allow separation of air inlet and outlet in the heat exchange mechanism*)
2. Use a smooth and impervious ice scoop at all times when ice is being handled – do not touch the ice
3. Store the ice scoop in a clean, lidded and washable container when not in use.
4. Wash the ice scoop at high temperature daily (e.g. in a dishwasher)

Maintenance

The machine should be cleaned weekly using the following technique:

1. Appropriate hand hygiene must be carried out and appropriate PPE donned prior to the task.
2. Disconnect machine from the power supply.
3. Remove and discard any ice still in the storage compartment.
4. Clean the machine internally and externally, including the storage compartment and removable parts, and allow to dry before reassembling
5. Record date and time of clean on the cleaning schedule.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT Deep Freezer

MAKE & MODEL Blue Star/ Celfrost

Requirement:

Procedure:

1. All items MUST be placed in a sample or soil box and put into a rack (DO NOT put samples in freezer in bags).
2. All freezer contents must be labeled (Contents, date (including year), owner)
3. Samples should be placed into the appropriate project freezer.

If a large number of samples to be stored, make sure there is sufficient space prior to the samples being shipped there.

4. Every time while opening a freezer, check for frost build-up on the seals and doors. Brush any frost off doors and remove ice from seals.
   a. Ice build-up causes the compressor to run more often reducing the life of compressor.
   b. Leaving the door to the freezers open for extended periods of time promotes the development of frost.
   c. Close doors as soon as possible, especially in the summer, to prevent frosting
   d. Note that the freezer may vacuum down the door and it may take several minutes for you to re-open the door.
5. An alarming freezer, one that is above temperature, or is making strange sounds must be immediately reported to lab staff/supervisor.

Maintenance:

Daily

a. Check the compressor for any unusual sound and for overheating.
b. Check for frost and ice build-up each time unit is opened
c. Check freezer temperature

Monthly

a. Remove dust, dirt and lint from condensers with a wire or stiff-bristle brush and vacuum it away. This is an important step because a dirty condenser can cause temperature loss and damage the compressor
b. Clean the filters and screens of the ventilator system with a brush or vacuum cleaner.

Every 6-12 months

a. Freezers should be defrosted at least annually. If frost is too thick to see the inside walls of the unit, the unit should be defrosted.
b. Remove all items from the freezer and into an alternate freezer space.
c. Switch the freezer off and disconnect it from the electrical supply. Open the freezer door and leave it open.
d. Position a container to catch the melted ice.
e. Never use sharp tools to chip off the ice.
f. Sponge up any melted ice.
g. Reconnect the freezer to the main power supply and switch it on.
h. Replace the original freezer contents once the temperature has reached

Department of Zoology

LABORARTORY SAFETY MANUAL

Safety in the science classroom and laboratory is the FIRST PRIORITY for students, instructors, and parents. To ensure safer classroom/laboratory/field experiences, the following **Safety Rules** have been developed for the protection and safety of all.
Safety in the laboratory can be addressed from three points of view:

- ***(i) Student preparation before the lab***
- ***(ii) Student execution during the lab:*** Students will be observed during the lab, but the preparation that the student does before the lab is even more important.
- ***(iii) Teacher monitoring during the lab:*** Teacher will provide additional rules for specific situations or settings.

Safety Standards of Student Conduct in the Classroom, Laboratory, and in the Field

1. Conduct yourself in a responsible manner at all times. Frivolous activities, mischievous behavior, throwing items, and conducting pranks are prohibited.
2. Lab and safety information and procedures must be read **ahead** of time. All verbal and written instructions shall be followed in carrying out the activity or investigation.
3. Eating, drinking, gum chewing, applying cosmetics, manipulating contact lenses, and other unsafe activities are not permitted in the laboratory.
4. Working in the laboratory without the instructor present is prohibited.
5. Unauthorized activities or investigations are prohibited. Unsupervised work is not permitted.
6. Entering preparation or chemical storage areas without instructor permission is prohibited at all times.
7. Removing chemicals or equipment from the classroom or laboratory without instructor permission is prohibited.
8. If you do not understand how or why to do a task, ask your instructor for help. If there is any doubt in your mind, ask your instructor.
9. Bring complete practical note-book; pencils of "HB" and "B"; pencil eraser and pencil sharpener or blade and sand-paper daily.
10. Keep your instruments, practical notebook and your seat clean, tidy and well arranged.
11. All your instruments should be sharp and according to the requirements.
12. Never rub pencils, to sharpen point, on table top or floor, because it spoils their show.
13. Never develop habit of taking things from or lending things to your fellow inside the laboratory. Come prepared from home with every requirement of the day.
14. Develop habit of removing your difficulties from your teacher directly. Never ask your neighbor for anything after you have once entered the laboratory.
15. Maintain silence in laboratory.
16. Clean your seat and wash instruments before you leave the laboratory.

17. While doing dissection put every waste in the sink. Don't drop anything on table's topor on floor.
18. While studying microscopically preparations never disturb the slide once fixed under microscope by your-teacher.

Personal Safety

1. When an activity requires the use of laboratory aprons, the apron shall be appropriate to the size of the student and the hazard associated with the activity or investigation. The apron shall remain tied throughout the activity or investigation.
2. All accidents, chemical spills, and injuries must be reported immediately to the instructor, no matter how trivial they may seem at the time. Follow your instructor's directions for immediate treatment.
3. Dress appropriately for laboratory work by protecting your body with clothing and shoes. This means that you should use hair ties to tie back long hair and tuck into the collar. Do not wear loose or baggy clothing or dangling jewelry on laboratory days. Acrylic nails are also a safety hazard near heat sources and should not be used. Sandals or open-toed shoes are not to be worn during any lab activities.
4. Know the location of all safety equipment in the room. This includes eye wash stations, the deluge/safety shower, fire extinguishers, the fume hood, and the safety blanket. Know the location of emergency master electric and gas shut offs and exits. Know how to USE all safety equipment in the room.
5. Know the location of the Emergency Evacuation Route map and how to read the map.
6. Wash your hands with soap/hand wash and water after handling any chemicals, glassware or touching any surface in the lab area before leaving the lab area.
7. When an activity or investigation requires the use of laboratory gloves for hand protection, the gloves shall be appropriate for the hazard and worn throughout the activity.
8. If you have a medical condition (e.g., allergies, asthma, etc.), check with your physician before working in lab.

Specific Safety Precautions Involving Chemicals and Lab Equipment

1. Avoid inhaling in fumes that may be generated during an activity or investigation.
2. Never fill pipettes by mouth suction. Always use the suction bulbs or pumps.
3. Do not force glass tubing into rubber stoppers. Use glycerin as a lubricant and hold the tubing with a towel as you ease the glass into the stopper.
4. Proper procedures provided by the instructor shall be followed when using any heating or flame producing device especially gas burners. Never leave a flame unattended.
5. Remember that hot glass looks the same as cold glass. After heating, glass remains hot for a very long time. Determine if an object is hot by placing your hand **close** to the object but do **not** touch it.
6. Should a fire drill, lockdown, or other emergency occur during an investigation or activity, make sure you turn off all gas burners and electrical equipment. During an evacuation emergency, exit the room as directed. During a lockdown, move out of the line of sight from doors and windows if possible or as directed.
7. Always read bottle labels twice before you use the chemical. Be certain the chemical you use is the correct one.
8. **Replace the top** on any chemical bottle as soon as you have finished using it and

return the bottle to the designated location (even if there are others behind you).
9. Do not return unused chemicals to the original container. Follow the instructor's directions for the storage or disposal of these materials.
10. All chemicals should be regarded as hazardous unless your instructor informs you otherwise.
11. Never mix or heat chemicals unless you are directed to do so.
12. When mixing concentrated acids and water, **always pour acids into water slowly and stir constantly.**
13. When observing the odor of any liquid, **do not smell it directly**. Use your hand to fan the odor towards you.
14. Never taste a chemical or a solution or touch chemicals with your hands unless directed to do so by your instructor.
15. When heating a test tube, do not heat just one spot on the test tube. Never have the open end of the test tube pointed at anyone. Never look directly down into a test tube.
16. Always allow ample time for cooling after materials have been heated. **DO NOT DISCARD or STORE HOT/HEATED OBJECTS**

Standards for Maintaining a Safer Laboratory Environment

1. Backpacks and books are to remain in an area designated by the instructor and shall not be brought into the laboratory area.
2. Never sit on laboratory tables.
3. Work areas should be kept clean and neat at all times. Work surfaces are to be cleaned at the end of each laboratory or activity.
4. Work deliberately and with definite purpose, but do not hurry.
5. Know what you are doing. Be wary of what neighboring students are doing.
6. Solid chemicals, metals, matches, filter papers, broken glass, and other materials designated by the instructor are to be deposited in the proper waste containers, not in the sink. Follow your instructor's directions for disposal of waste. If you are unsure, ask the INSTRUCTOR.
7. Do not overfill waste containers. If new waste container is needed, tell/ask the instructor/ Lab attendant.
8. Sinks are to be used for the disposal of water and those solutions designated by the instructor. Other solutions must be placed in the designated waste disposal containers. NEVER JUST POUR SOLUTIONS DOWN THE DRAIN. **Ask if you are unsure!!**
9. Glassware is to be washed with hot, soapy water and scrubbed with the appropriate type and sized brush, rinsed, dried, and returned to its original location.

Disposal Policies

1. Dispose of broken glassware in the marked cardboard box container. Broken glass containers are ONLY to be used for broken glass. Always use a broom and dust-pan if asked to clean up broken glassware.
2. Dispose of used slides in the glass, or plastic, container labeled "Used Slides".
3. Biohazardous wastes must be disposed in a biohazard waste container. Preserved materials (e.g. cat tissues) are not considered biohazardous waste and can be disposed in the regular trash. Your instructor will inform you which disposal containers are to be used with which type of biohazardous waste (metal sharps, glass, and non-sharps).

4. Uncontaminated gloves can be disposed of in the regular trash. Contaminated gloves must be disposed of in a biohazard waste container. Examination gloves used in dissections are not considered to be biohazard waste and can be disposed of in the regular trash.

While studying museum specimens take following cares:

1. First study the characters or peculiarities of that particular animal you wish to draw.
2. See and find out in the specimen before you all those characters and peculiarities which you have studied.
3. Draw the view in which maximum structures are visible.
4. Shading should be avoided in your drawing.
5. Compare your drawing from the drawing of this book for necessary details, corrections and labeling.
6. While drawing, special attention should be given to the length and width proportions of the animal.
7. Label your drawing with the help of book and put classification of the animal.

While making permanent slides (mounting) take following precautions:

1. Never keep your mounting material in a grade or reagent for more or less timethan required.
2. In absolute alcohol put your material for double the time than prescribed.
3. After using Eosin, never wash with 70% alcohol, instead dip in 90% alcohol but don't leave even in it for longer time.
4. Always put your material covered in any grade or stain.
5. Always use brush and never a force for holding the material.
6. After taking material out into next reagent change the used reagents.
7. 15. When you are not using the microscope, always keep it covered with its coveror with a towel.
8. While looking to a slide, never move the coarse adjustment too much for just clearing the image. Instead, use fine focus adjustment.
9. Use both eyes alternately while using a microscope.
10. Never tilt a microscope.
11. Have patience while doing dissection, drawing museum or studying permanent slides. Never be impatient or in hurry.

The handling of laboratory animals

The handling of animals, their care and husbandry, involves a number of different practices and procedures depending upon the species. The maintenance of stock animals and their experimental use in zoological teaching as weIl as in research work, requires the handling of the animals. Although satisfactory procedures are described for the handling of animals, confidence and efficiency can only be developed with practice. In order to protect itself while being handled, the animal may struggle to escape, bite or scratch. Therefore, both fear and anger should be avoided and handling should be gentle but firm. Those who are new to handling must spend some time in merely picking the animals up and transferring them from one cage to another until confidence has been gained about the ability to control the animal.

Different animal species require different handling techniques and the restraining techniques used should confirm acceptable practices, care being taken that neither handJer nor animal is injured. It is not possible to describe a technique for each species, therefore, only those species which are more frequently used in Zoology laboratories are described in this chapter. In general, pregnant animals should be handled with great care, giving support to the posterior region and avoiding constriction on the abdomen.

Reference: 257 S. B. Pal (ed.), Handbook of Laboratory Health and Safety Measures © Springer Science+Business Media Dordrecht 1990 HANDBOOK OF LABORATORY HEALTH AND SAFETY MEASURES

Care and maintenance of laboratory equipment

The care and maintenance of laboratory equipment is an integral part of quality assurance in the lab. Well-maintained lab equipment ensures that data is consistent and reliable, which in turn impacts the productivity and integrity of the work produced. Furthermore, since laboratory equipment generally takes up a big cut of the budget, good maintenance contributes to cost- cutting measures, by lowering the chances of premature repurchases and replacement. In addition, routine maintenance ensures that lab equipment is safe for use through highlighting and repair of faulty equipment and equipment parts.
Various procedures and routines will ensure that your laboratory equipment is well-maintained and cared for, this includes;

- Developing standard operating procedures for all lab equipment.
- Preparing documentation on each specific equipment, outlining the repairs and maintenance undertaken.
- Outlining a preventive maintenance program for each equipment.
- Training both technical and managerial staff on proper use and care of lab equipment.

A. Standard Operating Procedure for Maintenance of Lab Equipment

Standard operating procedures (SOPs) are a must for all complex lab equipment. This ensures that the correct use and maintenance of the equipment is integrated within routine work. Detailed instructions of equipment use should be sourced from the manufacturer's operator manual. The SOP can be written by the lab manager, an equipment officer, or staff that frequently works with the specific equipment. The SOP should also be easily accessible at the workbench.
A proper SOP should contain the following;

- The title and description of the content/scope of the SOP.
- Definitions of all abbreviations used.
- An outline of the personnel responsible for the equipment or involved in its use, including their qualifications and training requirements.
- Detailed instructions for the use of equipment, containing the do's and don'ts of operating them.
- A description of quality control and maintenance.
- Instructions on waste management, where applicable.
- Reference documents, such as manuals used to prepare SOP and manufacturer's websites, should be outlined for use when further information is required.

B. Equipment Maintenance Documentation

This is a centralized collection of all the information regarding particular equipment. It is a reference archive for equipment maintenance that can be used to understand the history of the equipment. It is usually organized by the lab manager or the lab's equipment officer. The maintenance log outlines equipment identification and descriptions like equipment name, model number, manufacturer, purchase date, warranty, model, etc. It also contains description of repair work, parts replacements, tests, measurements, adjustments, or deep cleaning done on the equipment.

A regularly updated equipment maintenance log can help to:

- Highlight trends like repair costs and equipment durability and efficiency. Therefore, helping lab managers to make decisions on equipment models and brands that are best suited for the lab.
- Point out the equipment that undergoes wear and tear frequently. If the cause of malfunction is operation related, it can highlight the need for re-training of laboratory staff.

C. Preventive Maintenance Program

A preventive maintenance program ensures that the equipment is functioning with minimal interruptions and within the manufacturer's specifications. It maximizes the equipment operational efficiency and reduces overall costs. It is mainly recommended for equipment with moving parts, gas or liquid flow, optical systems and filters.The maintenance and quality control is performed under an outlined schedule and results are documented.
A preventive maintenance file should detail;

- Error alerts on the equipment and subsequent action to be taken.
- Basic troubleshooting when the equipment malfunctions.
- Logs for error reports and failure events
- The servicing and calibration done on the equipment and the dates for subsequent calibrations.

Stickers should be used for equipment labelling to summarize the preventive maintenance actions undertaken, the date, and the personnel involved.

D. Training Laboratory Staff on Equipment Maintenance

Training of both technical and managerial staff is not a onetime activity. It should be regular with additional courses given when new equipment or improved models are bought. The initial induction training should be elaborate with an expert-guided discussion and demonstration, while follow-up training can be done in-house to refresh the staff technique. The lab manager or lab quality control officer is responsible for ensuring all staff are well trained.
For proper staff training on equipment care and maintenance;

- Provide all necessary documentation including SOPs, maintenance logs, service manuals etc.
- Ensure that the staff has, along with theoretical presentation, a practical on-the-job training on use and maintenance of lab equipment.
- Train all staff on preventive maintenance, where they learn the general care of equipment like lubrication and checking for possible damage.
- At the end of the training, a scoring system should be availed to evaluate the effectiveness of the training.

E. General Care Tips for Lab Equipment

1. Cleaning

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

Make certain that;

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

2. Calibration

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

Calibration should be done when;

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

3. Repairs and Refurbishments

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

The following are points to consider;

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

4. Quality Replacement

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

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

Standard Operating Procedure

1. Light Microscope

1. Read and be familiar with the user manual for your model of microscope.

2. Carry the microscope with two hands, one under the base and the other gripping the arm or frame.

3. Gently place the microscope on a flat, level surface and plug into a power source. Some microscopes have a built in light source but others have a mirror to focus natural light or an external light source.

4. With a built-in light source, turn on the light source and adjust the light setting so that it is not too bright by turning or sliding the brightness adjustment knob on the base.

5. 'If using an external light source directs the light via the mirror. Rotate the low power objective into position. Remove the eyepiece, look down the body tube and adjust the mirror and diaphragm setting so light is reflected up the tube and a circle of evenly illuminated light is visible in the field of view. Replace the eyepiece. Use the concave mirror side if the microscope has a fixed condenser lens or the flat mirror side if the microscope has an adjustable condenser.

6. The iris diaphragm is located just above the light source on the bottom side of the stage. Using the lever attached, you can increase or decrease the amount of light reaching the specimen. Look through the eyepiece and adjust the sub-stage iris diaphragm to allow sufficient comfortable light through.

7. Between the stage and the iris diaphragm is the condenser. The condenser further aids in the focusing of the light onto the specimen. In some microscopes it can be moved up and down. To begin with, position it close to the stage. If you have a problem focusing your specimen then adjust the position of the condenser.

8. Adjust the stage down as low as possible with the coarse focus knob.
9. Begin by viewing the specimen with the lowest power objective lens in place and then increase to the higher power objective lenses.

10. Select the 4x scanning objective by rotating the nosepiece, ensuring it clicks into place.

11. Place a prepared slide onto the stage and hold it in place with the metal clips. Centre it so that the specimen is under the objective lens. Move it with the stage control knobs either left to right or backwards and forwards.

12. After placing the slide on the stage look at the objective lens and the stage from the side and use the coarse focusing knob to bring the slide as close to the objective as possible without touching it.

13. Look in the eyepiece/s and slowly move the stage away from the objective lens with the coarse focusing knob. Stop when the image comes into view.

14. If using a binocular microscope adjust the distance between the eyepieces to suit your eyes by sliding the eyepieces in and out until you see one image. This is called the interocular distance.

15. Use the fine focus to sharpen the image. Scan the slide, select the part of the specimen you are interested in and center it in your field of view.

16. Adjust the sub-stage iris diaphragm to optimize the lighting.

17. Rotate in the low power 10x objective and refocus with the fine focus. You may need to open the iris diaphragm to let more light in. In general, the higher the power, the more light you require.

18. Repeat with the high power 40x objective, adjusting the iris diaphragm if required. Use only the fine adjustment knob to focus the microscope when using the higher power objective lenses.

19. If you have a 100x oil immersion objective, you will need to first focus on the specimen with the 40x objective. Next rotate the nosepiece so that a midway position is obtained between the 40x objective and the 100x objective. Place a small drop of immersion oil onto the slide cover slip then continue to rotate the nosepiece so that the 100x objective is rotated into the oil. The immersion oil should be used sparingly. Never use immersion oil with any of the other objectives. (Note: It is possible to place the oil directly on a specimen that has been fixed or heat fixed and stained without a cover slip, e.g. bacterial slides. However, it is difficult to remove the oil from the slide without damaging the smear.) Any attempt to re-look at the slide with a low or high power objective may result in contamination of these objectives with the immersion oil. Do not use immersion oil on a wet mount unless you can secure the cover slip well.

20. Sharpen the image with the fine focus only and adjust the light with the iris diaphragm if required.

21. When finished, lower the stage, rotate the low power objective (4x) into position and remove the slide.

22. Clean the oil off the slide and the objective when finished with lens tissue and lens cleaning fluid. In order to return to work at the lower magnifications, the slide must be completely cleaned of any residual oil. Wipe the stage clean with a paper towel.

23. Turn off the light and at the main switch.

24. Report any problems to your teacher.

25. Cover the microscope with its dust cover.

Microscope handling and storage:

1. When work is completed, lower the stage, remove the slide, rotate in the lowest power objective, wrap the cord loosely around the base and cover with a dust cover. Take care not to wrap the cord around a hot (built in) light source.

2. Always keep your microscope covered when not in use. Optics and mechanical parts must be protected from dust.

3. Always move the microscope with one hand under the base and the other hand gripping the arm or frame.

4. Keep microscopes away from vibration, moisture, high temperatures and direct sunlight.

5. Never store microscopes in chemical storage areas as corrosive fumes may damage metal and lenses.

Microscope maintenance:

1. Treat lenses with great care as they can be easily scratched. Never use anything abrasive.

2. When cleaning lenses, first blow away any dust with a blower brush then use lens tissue and lens cleaning fluid such as Windex® to clean the objectives and eyepieces. Do not use paper towel or regular tissues, as they will scratch the lens. Do not use other solvents.

3. Do not remove eyepieces or objectives from their location but clean only their external surfaces.

4. Remove immersion oil from the 100x objective immediately after use with lens tissue and lens cleaning fluid.

5. Wipe dust off the body of the microscope with a damp cloth.

6. Never attempt to take a microscope apart. This could impair operation, efficiency and accuracy.

7. Have the microscope serviced regularly by a professional, as most microscopes require periodic lubricating and minor adjustment of their mechanical parts.

8. Follow your user's manual for instruction in replacing the bulb. Always allow a bulb to cool before replacing it. When replacing bulbs avoid touching the glass with your hands, use a tissue. Fingerprints can reduce bulb quality and reduce its life.

2. Paraffin Wax Bath

Standard Operating Procedure:

1. Paraffin wax bath therapy (P.W.B)is an application of the molten paraffin wax on the body part.

2. The melting point of wax is 51-55°c. If the molten wax at 51-55°c is poured on the body part, it may cause burn. Some impurity like liquid paraffin or mineral oil is added to lower the melting point for safe application. Thus the temperature of the paraffin wax is maintained at 40-44°c.

3. The combination of the wax and the mineral oil has low specific heat. This enhances the patient's ability to tolerate heat from the wax better than from the water of the same temperature. The composition of the wax: paraffin: mineral oil is 7:3:1 or Wax: paraffin or mineral oil is 7:1. The mode of the transmission of heat from paraffin to the patient skin is through conduction.

4. Paraffin has a slow thermal conductivity. Slow heat diffusion (6 times lower than water). Paraffin wax has a low melting point (55°). When the oil is added, the paraffin will remain at a temperature of 40° to 44°C. This low specific heat will enhance the patient to tolerate heat from the paraffin better than from water of the same temperature.

5. It gives moist heat. There is a layer between the skin and the wax producing heat and sweating which does not evaporate. After removal the heated part cools quickly by evaporation. It is analgesic. This insulating layer keeps the heat and is effective in relief of pain.

6. Container is made up of enameled baths or stainless steel and fiberglass shell. Container contains wax and paraffin oil in the prescribed ratio. Thermostat keeps the temperature adjusted with knob. Thermostat pilot's lamp indicates whether thermostat is on or off. Power pilot's lamp show whether power is on or off. Lid cover container and caster allow the paraffin wax bath container to be move from place to place.

7. Dipping and Wrap: most common method. Involves placing the body part to be treated in a paraffin bath, followed by removing it and allowing the paraffin to cool and harden. Approximately 7 to 12 dips are done followed by wrapping in wax paper or plastic, which is covered by towels or insulated mitts. Application time is 20 to 30 minutes or till wax cools.

8. Dip once for having a glove. Then immerse for 15 to 20 min. Never immerse at first for a long time without making a glove dry before to have insulations.

9. The molten Wax is directly poured by a mug or utensil on the part to be treated and wrapped around by a towel. The wax is allowed to solidify for about 10-20 minutes. Several (4-6) layers can be made over the body tissues.

10. A towel or a roll of bandage is immersed in molten paraffin wax and wrapped around the body part. Several layers can be made over the body part. This method is preferably used for treating proximal parts of the body.

11. It is a less commonly used method of paraffin wax application. 8-10 coats of wax are applied to the area with a paint brush using even and rapid strokes. The area is then wrapped with towel for 10-20 minutes and after this time, paraffin wax is removed and discarded.

12. Wax softens and facilitates the mobilization and stretching procedures.

3. Digital Incubator

Standard Operating Procedure:

1. We ensure that the incubator is properly connected to the power supply.

2. We switch on the main.

3. We turn on the red color power knob towards 0-1.

4. We turn on the cooling knob towards 0-1.

5. To set the incubator at 22°C, we set the lower temperature 21 OC by pressing the 'SET POINT -1' and simultaneously adjust the temperature with the help of screw of SET and RST by screw driver.

6. We set the higher temperature 23 OC by pressing the 'SET POINT -2' and simultaneously adjust the temperature with the help of screw of SET and RST by screw driver.

7. In the same manner the incubator can be set to 37°, 44° and 55°C whenever required by setting the lower temperature to 36°,43° and 54° C respectively and by setting the higher temperature to 38°,45° and 56° C respectively.

8. We record the temperature twice daily, i.e., in the morning and in the evening. The temperature should not differ ± 2° C from the set temperature.

Troubleshooting problems and remedial action:

1. The temperature display is not glowing. We check for power supply and proper electrical connections of instruments with power point.
2. Temperature is not even in the incubator. The air circulating fan may not be functioning. We check for it.
3. We report any discrepancy observed during operation or temperature monitoring to Q.C. Executive and notify the defect to Maintenance Department.

Calibration:

1. We set the incubator temperature to 22°C. We wait till the set temperature is reached.
2. We take a calibrated thermometer and dip it in a 500 ml beaker filled to 3/4 of the volume with Glycerol AR grade.
3. We keep the beaker inside, at the center of the incubator. close the incubator door. Allow the temperature to equilibrate for 30 minutes.
4. We observe the temperature shown by the thermometer. The temperature shown by the display and by thermometer shall not differ by more than 0.5°C.
5. We record the temperature at two time intervals (with a gap of 6 hours) in the temperature record.
6. By following the same procedure as above we carry out calibration by setting the incubator temperature to 37°C, 44°C and 55°C.
7. We record any discrepancy observed during operation or during temperature monitoring to Quality Control Executive and notify the defect to technical assistant for rectification. We affix "BREAK DOWN" label on the instrument.

Frequency of calibration:

1. Once a month and after each maintenance job.
2. Record the calibration record in the format prescribed.

4. Electronic weight balance

Standard Operating Procedures:

1. Check whether the sensitivity of the balance is appropriate for the amount of material to be weighed.
2. Zero the balance before use.
3. Put material to be weighed in a suitable container or on weighing paper, never directly on the pan of the balance.
4. Determine the mass of the weighing container or paper and then press tear to deduct the weight of the paper or container
5. Place the material to be weighed in the container or on the weighing paper in the middle of the pan to avoid corner-load error.
6. Note the mass of the substance being weighed from the screen of the balance.
7. To prevent contamination of stock material, do not return unused substance to the stock bottle.
8. Clean the balance with a soft, clean brush after use.
9. Refer to manufacturer's manual for other instructions on cleaning.
10. Balance pans and the working area can be disinfected with 70% ethanol.

5. UV Trans illuminator

Standard Operating Procedure:

1. Place the transilluminator on a level work surface.
2. Plug in and turn on the main power switch.
3. Open the UV Protection Cover and place the gel on a gel-tray on the filter surface. This is to protect the filter surface from cuts and scratches.
4. Close the UV Protection Cover to protect or shield the user from UV emitted from the machine.
5. Wear UV-protective face-shield. Press the ON/OFF power switch to ON. The UV tubes within the unit should be glowing beneath the filter.
6. After viewing or excising the gel, turn off the UV light and wipe clean the surface of the UV light box with distilled water and 70% ethanol.
7. If the gel is no longer needed, dispose it into the purple color double-bagged cytotoxic bin designated for agarose gel. After the bin is full, wastes are secured tightly and disposed into the 120-litre cytotoxic bin provided. The cytotoxic bins are disposed by licensed waste collectors whenever the bin is full.

Safety Precautions

1. UV Transilluminators are powerful sources of UV radiation that will cause damage to unprotected eyes and skin.
2. Before operating any unit, be sure all personnel in the area are properly protected.
3. For the main operator, wear proper PPE including lab coat, nitrile gloves, covered shoes and UV-protective face-shield to avoid contact with the ethidium bromide stained gel and accidental exposure to UV light.
4. Ensure the UV Protective Cover is properly positioned before switching on the machine.

Maintenance

1. Clean unit surface with a damp soft cloth or sponge. Never use abrasive cleaners as it can damage the UV filter surface.

2. To protect the filter glass and minimize moisture and liquids on the glass, it is recommended that a UV transmitting gel tray is use

6. Digital Photo Colorimeter
Standard Operating Procedure:

1. Switch on the Colorimeter by switch.

2. Wait for 2 Minute until the fluctuation will not stop.

3. Set the %T at zero.

4. Take the Cuvette and clean it very properly. There should not be any trace on the surface of the Cuvette.

5. Fill the amount with Liquid in the Cuvette which we are going to measured.

6. Place the Light Shield in the box (Black in color).

7. Place the Cuvette very slowly in the Cuvette chamber.

8. Wait for 1 minute and note down the Optical Density of the given liquid material.

9. Switch off the Instrument.

Maintenance
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.

7. Tissue Homogenizer
Standard Operating Procedure:

1. Test proper functioning of unit initially with a water sample. With speed control at zero, turn on main switch. Gradually increase speed until motor is running.

2. Different types of tissue require different speeds and times. Ensure the conditions for your sample are appropriate.
3. Maximum and minimum volumes for the unit should be followed at all times.
Maximum _____
Minimum _____
4. Consider the appropriate sample-to-solvent ratio. It is preferable to use the smallest sample volume and the smallest container possible, which increases the sample exposure to the generator.
5. Samples should be approximately the same size as the generator diameter. Some initial fragmentation may be required to achieve this.
6. It may be preferable to run the motor in short bursts (~15 seconds) rather than for an extended time.

Maintenance

1. Thorough cleaning is necessary after each use. Either run at low speed in water for a few minutes, or, with motor off, rinse with water.
2. If homogenization is done in organic solvents, rinse as above when finished.
3. Motor brushes should be checked after 100 hours of operation, or as recommended.

Precautions

1. Normal electrical precautions should be followed.
2. Gloves, eye & ear protection are required.
3. Avoid exposure to aerosols by using in a Biological Safety Cabinet.

8. Gel Electrophoresis Unit

Standard Operating Procedure:

1. Preparing TAE and TBE Buffer for electrophoresis systems

2. These buffers are used because they both have a basic pH which gives the phosphate group of the DNA a net negative charge allowing migration of the DNA toward the positive anode.

3. TAE buffer is best used when DNA is to be recovered from the gel and for electrophoresis of large (>20kb) fragments. TBE is best used for smaller (<1kb) fragments due to high ionic strength and high buffering capacity. Also it reacts with agarose making smaller pores and tighter matrix.
4. TAE-Tris acetate w/EDTA (40mM Tris base, 40mM acetic acid, 1mM EDTA)

50x Stock solution, pH ~8.5

242g Tris base

57.1ml glacial acetic acid

18.61g Na2EDTA-2H2O (MW 372.24)

Distilled/RO water to 1 liter final volume

5. TBE-Tris borate with EDTA (89mM Tris base, 89mM boric acid, 2mM EDTA)

10x Stock solution

108g Tris base

55g boric acid

7.44g Na2EDTA-2H2O (MW 372.24) (Or 40ml of 0.5M EDTA, pH 8.0)

Distilled/RO water to 1 liter final volume

Making a GEL
(Note: an increased % in agarose gives better separation of small fragments and bands that are close in size.)

FOR MAKING A 1% GEL

1. Dissolve 0.4g of agarose in 40ml of electrophoresis buffer (TBE or TAE) by heating in a microwave.
2. After heating and fully dissolving the agarose add 4uL of SYBR SAFE directly into the liquid via pipette, mix by gentle swirling.
3. Use this mixture to cast a gel
4. Place the gel tray into the gel box so that the gasket (Ends with rubber strip) forms a seal against the walls of the gel box make sure to press the gel tray all the way down so that the gel box and gel tray are level.
5. After the gel mix has cooled to 60C (Higher temps will damage and warp the gel box) pour the mix into the gel tray. Upon pouring the gel mix immediately insert the gel comb with the desired number of teeth/wells.
6. Allow the gel to solidify completely. Then lift the gel tray out of the gel box turn it 90O and replace it into the gel box with the comb closest to the cathode.
7. Pour running buffer into the gel box to fill the chamber and completely submerge the gel (300ml).
8. Carefully remove the comb using a light tapping motion to avoid damage to the wells.

(Please note the maximum volume for a gel of this size using a B1A-10 comb is 13.5uL)
(For other combs use the calculation below to determine well volume and x 0.75 of this value for loading volume. Please note well height will remain 6mm unless volume of gel cast is increased from 40ml.)

(Well height (mm)-1.5) x (Tooth width x Comb thickness)

1. Pipette 10uL of your sample into a clean tube.
2. Add 2uL of loading dye (Bromophenol blue) (Blue dye) for visual tracking.
3. Mix by low vortex and spin on mini-fuge to ensure all sample is at the bottom of the well.
4. Plan out your gel before pipetting and create a reference chart/diagram to ensure correct samples are put into the correct wells. Also that you have a negative and positive control in addition to a hyperladder on one or both ends of the gel (First and last well).
5. Carefully pipette all of sample into the correct well on your gel using 10xL pipette tips (Or any compatible extended length tips)
6. Add 10uL of the hyperladder for reference/comparison in at least one or if possible both ends of your gel (First and last wells)

Connecting and starting power supply

1. Carefully place the lid on the top of the gel box, ensure it is completely pressed down and level.
2. Make sure red wires connect to red port on box and black wires to black port.
3. Connect the wires to the correct color terminals on the power supply.
4. Plug in the power supply
5. Set voltage to 150V
6. Ensure bubbles start to form on both sides of the gel box where the buffer reservoirs are.
7. After 45 minutes the gel should be complete check that samples have migrated by looking through the lid.
8. Turn off power supply.
9. Disconnect power supply from outlet.

Visualizing the gel

1. Ensure power supply is turned off.
2. Remove lid from gel box.
3. Wait approx. 10mins for gel to cool.
4. Carefully remove gel.
5. Place gel onto a blue light transilluminator (Optimal due to maxima excitation wavelength).
6. Place orange filter over to protect eyes.
7. Turn on transilluminator; bands should be visible in addition to a clear hyperladder.
8. Take picture via gel doc system on other device (Cell phone) as soon as possible to avoid degradation of fluorescence.
9. Annotate gel picture to transcribe your reference chart for sample in each well including negative and positive control (See below)

9. Haemoglobinometer
Standard Operating Procedure:

1. N/10 Hydrochloric acid is taken in Hemoglobin tube (has two graduations – one side gm/dl, and other side shows the Hb %age), up to the mark 20 – the lowest marking (yellow marking).

2. Venous or Capillary blood is drawn up to 20µl mark of hemoglobin pipette exactly.

3. N/10 Hydrochloric acid is taken in Hemoglobin tube (has two graduations – one side gm/dl, and other side shows the Hb %age), up to the mark 20 – the lowest marking (yellow marking).

4. Venous or Capillary blood is drawn up to 20µl mark of hemoglobin pipette exactly.

5. Check out the steps of venous blood collection

6. For capillary blood draw, boldly prick the tip of the middle or ring finger with the help of Blood lancet or pricking needle. Wipe out the first drop of blood and suck the blood from the second drop in Hb pipette up to the mark of 20 µl. Fill the Hb pipette by capillary action.

7. Wipe out the surface of the pipette with the help of tissue paper/ cotton so that excess blood may not be added to the Hb tube.

8. Dispense the blood into N/10 hydrochloric acid taken in the hemoglobin tube, rinse the pipette with the same solution and mix properly with the help of stirrer.

9. Place the tube at room temperature for 10 minutes for complete conversion of hemoglobin into acid hematin.

10. After the reaction completes, place the Hb tube in the column in Sahli's Comparator box and start diluting the dark brown coloured compound (Acid Hematin) formed in the Hb tube using the N/10 HCl or distilled water by adding drop by drop of it into the solution and mix with the help of stirrer after each addition.

11. This process is done until the endpoint comes matching the color of standard with the color of the test.

12. Once the color is matched with the standard brown glass, lift the stirrer up and note down the reading in Sahli's Hb tube by taking the lower meniscus in consideration.
(Note: Usually in colored solution, the upper meniscus is considered for taking the reading but in this case, it is a transparent color solution and lower meniscus can be recorded in order to give the exact reading.)

13. Now add one more drop of distilled water and mix it properly with the help of stirrer. If color is still matching with the standard add another drop till it matches with the standard and note down the reading and, if it gets lighter after adding the first extra drop, it shows reading taken before dilution was correct. Note down that reading as the final result.

14. Reading of this method is expressed in Hemoglobin gm/dl (gram/100 ml) of blood.

Precautions:

1. Sahli's apparatus especially the Hemoglobin pipette and Sahli's Hemoglobin tube should be clean and dry before use.

2. Suck the blood exactly up to the mark of 20 µl (0.02 ml) and air bubbles should not be present in the pipette with blood.

3. Mix well the acid and blood and wait for at least 10 minutes after adding the blood in acid.

4. Add distilled water drop by drop and mix well after each dilution. Avoid over dilution of the content.

5. The matching of color should be done against the natural source of light or electrical tube light (white light) to avoid any visual errors.

6. Blood sample and N/10 HCl acid should be taken in an accurate and precise amount in the Hb tube.

7. The Hb pipette should be wiped off properly in order to avoid the excess addition of blood in the Acid

10. PCR Unit
Standard Operating Procedure:

1. Set up the reaction wearing gloves at all times and label the lids of the eppendorf, as anything written on the sides will not remain after being in the PCR machine.

2. Take care to avoid carry over between tubes or contamination of stock Note: Include the following control reactions for each DNA template. (i) Positive DNA control if appropriate (ii) Negative DNA control if appropriate (iii) No template control using sterile water instead of DNA

3. A typical reaction is as follows: Sterile pure water 42µl 10 x AJ buffer 5µl Primer 1 (Forward) 10pm/µl 1µl Primer 2 (Reverse) 10pm/µl 1µl Template DNA or cDNA 1µl 50µl Note: When using cDNA preparation containing Dynabeads as template, ensure complete mixing of the bead suspension . before removing an aliquot for PCR.

4. Spin the tubes briefly in a microfuge.

5. Place the eppendorf in the thermal cycler and carry out an initial denaturation at 98°C for 3 minutes.

6. Cool the PCR machine to 80°C (or annealing temp) and pause it at this temperature Add 1 unit of Taq polymerase (1□l of Taq diluted 1:5 or 2□l of a 1:10 dilution in 1 x AJ buffer)

7. Re-start the machine and amplify the DNA for between 25 - 40 cycles. Parameters for a typical cycle might be: 94°C 30 sec. Denaturation 60°C 30 sec and annealing of primers 72°C 30 sec. Extension of sequences.

8. Remove tubes from Thermal cycler.

9. Analyze the PCR products on a 3% HGT agarose gel, as described in SOP 504. Ideally, PCR products should be manipulated away from PCR set-up areas and different sets of Gilsons should be use

11. Mini Centrifuge
Standard Operating Procedure:

1. We load the sample.

2. Select the appropriate centrifuge based on the volume of the sample(s) and the desired speed and temperature.

3. Ensure that the centrifuge is located on a rigid, flat, level surface.

4. Remove or lift cover from centrifuge. Insert sample(s) into the rotor making sure to place two samples opposite of each other to maintain balance.

5. If an odd number of samples need to be spun, make a counterbalance by filling an empty test tube or micro-centrifuge tube with an equal volume of water.

6. Securely screw on or close the lid of the centrifuge.

7. Set the desired speed, time, and temperature (if applicable) on the centrifuge.

8. Press the “Start” button and wait for the instrument to ramp up to the desired speed.
(Note: It is normal to see a small vibration in the instrument as the speed increases, but any large vibration in the instrument or irregular noise may indicate that something has gone wrong with the run. Press the “Stop” button and make sure that the tubes are balanced properly.)
9. When the run has completed and the rotor has come to a complete stop, unscrew the rotor lid and carefully remove the samples to prevent re-suspension of the sediments.

Department of Botany

Maintenance of Laboratory Equipment policy

This guideline deals with some equipment commonly used in Botany laboratories of USTM. However these principles could be applied in the maintenance of other equipment in the laboratory as well. The maintenance programme developed in the laboratory includes the following components.

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

GENERAL SAFETY

People who work in scientific laboratories are exposed to various hazards. Most workplaces have hazards that are well recognized (those of ordinary fire, for example) with well-defined actions to control the situation.Laboratories, however, involve a greater variety of possible hazards and some of these hazards need precautions not ordinarily encountered. An introduction to safe practices for a variety of widely used laboratory procedures is listed below:

GENERAL SAFETY AND OPERATIONAL RULES OF BOTANY LABORATORIES

1. No running or jumping in a laboratory is permitted. Stored items or equipment shall not block access to the fire extinguisher(s), safety equipment, or other emergency items. Stairways, hallways, passageways/aisles and access to emergency equipment and/or exits must be kept dry and unobstructed; i.e., no storage, no equipment, phone or other wiring. No combustible material such as paper, wooden boxes, pallets, etc., shall be stored under stairwells or in hallways. Hallways shall be kept free of boxes and materials so that exits and normal paths of travel are not blocked.

2. Eating or drinking within laboratories is not permitted. In all laboratories specific office areas may be designated for food in coordination with the Safety Committee.They must be physically separated from any laboratory operations. In the specified office areas no consumables, reagents or any tools should be shared with work areas.

3. No food or beverage may be stored in the cold rooms/Laboratory refrigerators and freezers.

4. Working core hours at NCBS/InStem/CCAMP are 8am – 8pm (Mon.-Sat.). No employee shall work alone in a laboratory or chemical storage area outside the core working hours. Permission for students and staff to work outside of the core time has to be granted by the PI in charge in writing.

5. Animals, except those that are the subject of experimentation (approved by the Animal Experimentation Committee) are to be excluded from all laboratory areas

6. Clothing worn in the laboratory should offer protection from splashes and spills, should be easily removable in case of an accident. Nonflammable, nonporous aprons offer the most satisfactory and the least expensive protection. Lab jackets or coats should have snap fasteners rather than buttons so that they can be readily removed.

These coats are to be fastened closed while working and removed prior to exit from the laboratory. It is highly recommended that no sandals or open-toed shoes shall be worn by laboratory personnel in the laboratory. Laboratory clothing should be kept clean and replaced when necessary. In procedure performed in biosafety level 2 and chemical operations it is required that lab coats, gloves, closed shoes and safety glasses are worn.

7. Mouth pipetting is never allowed.

A. Electrical

The typical laboratory requires a large quantity of electrical power. This increases the likelihood of electrically-related problems and hazards. One must address both the electrical shock hazard to the facility occupants a nd the fire hazard potential. The following recommendations are basic to a sound electrical safety program in the laboratory.

1. All electrical equipment shall be properly grounded.
2. Sufficient room for work must be present in the area of breaker boxes. All the circuit breakers and the fuses shall be labeled to indicate whether they are in the "on" or "off" position, and what appliance or room area is served. Fuses must be properly rated.
3. Equipment, appliance and extension cords (junction boxes) must be in good condition and must be routinely dusted.
4. Extension cords shall not be used as a substitute for permanent wiring.
5. Electrical cords or other lines shall not be suspended unsupported across rooms or passageways. Cords over metal objects such as emergency showers, overhead pipes or frames, metal racks, etc are not allowed to be routed. Cords are not run through holes in walls, ceilings, doorways or windows. Do not place under carpet, rugs, or heavy objects. Do not place cords on pathways or other areas where repeated abuse can cause deterioration of insulation.

6. Multi-outlet plugs are not being used unless they have a built-in circuit breaker. This

causes overloading on electrical wiring, which will cause damage and possible overheating.

7. Most of the portable multiple outlets are rated at15 amps. Employees check when all connections are made to determine that the total input average will never exceed 15 amps. (The amperage on electrical equipment is usually stamped on the manufacturer's plate).

8. All building electrical repairs, splices, and wiring are performed by the Electrical Department be vented to the outside using explosion proof methods.

B. Handling Glassware

1. Glass breakage is a common cause of injuries in laboratories. Only glass in good condition should be used.
2. Clean all glassware before sending for repair. Glassware that has been in contact with infectious agents shall be disinfected before disposal or repair.
3. Protect hands with leather gloves when inserting glass tubing. Hold elbows close to the body to limit movement when handling tubing.
4. Use glassware of the proper size. Allow at least 20% free space. Grasp a three-neck flask by the middle neck, not a side neck.
5. Conventional laboratory glassware must never be pressurized or used with vacuum.

2.0 - Safe Handling of Chemicals
General Guidelines.

Working with potentially harmful chemicals is an everyday occurrence in a laboratory. Employees are requested to inform themselves about toxicological information and procedures for handling and storage of chemicals used.

Basic Working Principles in Bio-safety laboratories

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

A. **Wash your hands thoroughly**:

1. Before and after working with any biohazard
2. After removing gloves, laboratory coat, and other contaminated protective clothing

3. Before eating, drinking, smoking, or applying cosmetics
4. Before leaving the laboratory area
5. Do not touch your face when handling biological material

6.Never eat, drink, smoke, or apply cosmetics in the work

Area

B. Clothing Guidelines:

1. Always wear appropriate lab clothes and gloves when working with biological agents.
2. Wear gloves over gown cuffs.
3. Remove gloves by peeling them from the inside out.
4. Never wear contact lenses when dealing with infectious agents.
5. Do not wear potentially contaminated clothing outside the laboratory area.
6. Additional appropriate protective clothing should be selected and worn based upon the task and degree of exposure anticipated.

C. **Handling Procedures liquid infectious materials**:

1. Use mechanical pipetting device (examples; pipette aid, pipetteman or bulb).
2. Minimize aerosol generation. Decanting culture supernatants, opening of culture and streaking of plates should only be done in Safety cabinets or in a circular area around a burner of 0.5 meter radius. Decanting/Transferring of cultures in common equipment rooms outside of safety cabinets is forbidden.
3. Add disinfectant to water baths for infectious substances.
4. Use only closed tubes for centrifuging procedures. Inspect the tubes before use.
5. Use secondary leak-proof containers when transporting samples, cultures, inoculated petri dishes, and other containers of biohazardous materials within the institute.
6. Avoid using syringes and needles whenever possible. Special care has to be taken when usage of needles is not avoidable:

D. Work Area:

1. Keep laboratory doors shut when experiments are in progress.
2. Limit access to laboratory areas when experiments involving biohazardous agents are being performed.
3. Ensure that warning signs are posted on laboratory doors. These signs should include the universal biohazard symbol and the approved biosafety level for the laboratory.
4. Transport contaminated materials in leak-proof containers.
5. Keep miscellaneous material (i.e., books, journals, etc.) away from potentially contaminated working areas.

Safety Rules for the Biology Lab

1. Do not perform unauthorized experiments.
2. Keep quiet and disciplined, and observe cleanliness in the lab.

3. You must wear lab coat, safety goggles, protective gloves and a surgical mask before performing the experiment.

4. Wear shoes which completely cover the feet. Sandals, open-toed shoes are not permitted.

5. Tie back long hair.

6. Do not wear contact lenses.

7. Eating, smoking and drinking are not allowed in the lab.

8. Be aware of the location of the exits, fire extinguishers, fire blankets, safety shower, eye wash, first aid box and emergency phone numbers.

9. All aisles must be kept open all times.

10. Do not use the flame to heat flammable liquids, use water bath.

11. Keep hands away from your face, eyes and mouth when working with cadavers, chemicals, preserved specimens and microorganisms.

12. If any chemicals or other agents splashes into your eyes rinse immediately with large quantities of water.

13. Scalpels and other sharp objects can be used only if authorized by the lab technician.

14. When handling sharp objects in anatomy classes point their tips down and away from other people.

15. Examine all apparatus for defects before performing any experiment.

16. If the fire alarm sounds you must evacuate the building via the nearest exit.

17. Before leaving the lab makes sure that your work area is clean and tidy. Ensure that all Bunsen burners and water taps and all microscopes are completely turned off.

Maintenance policy of few important instruments are listed below:

A. Maintenance of Microscope

Special care should be paid to each part of the microscope. Maintenance should be done according to a time schedule.

Periodic procedure in maintaining a microscope should be done at least once a year.

1 If microscopes are used continuously, maintenance should be performed twice a year.

2. Schedule a complete general cleaning and readjustment. .

Record all preventive maintenance and repair data as shown below.

3. Date of maintenance

5. Microscope identification number
6. Names of company and representative
7. Type of maintenance and /or repairs done
8. Part replaced
9. Recommendations for next evaluation
10. Estimated cost if you have such information
11. This information should be cumulative so that a review for each piece of equipment can be scanned quickly for continuing problems, justification, information for replacement requests, etc.

B.Maintenance of Centrifuge

i. Inspection before each run

• Visually check the carrier cups, trunnions and rotor for corrosion and cracks.

• If anything is found to be defective, replace it immediately or remove the equipment from service.

• Check for the presence and insertion of the proper cup cushions before each run.

ii. Quarterly and periodic checks

• At least quarterly checks need to be done

• Check the speed at all regularly used speeds with a stroboscopic light to verify the accuracy of a built-in tachometer or speed settings.

• Remember to record the results.

• Perform this function every six months or yearly.

1. Following a breakage or spill and at least monthly;

• Disinfect the centrifuge bowl, buckets, trunnions, and rotor with 10% household bleach or phenolic solution.

• Following disinfection, rinse the parts with warm water and perform a final rinse with distilled water.

• Thoroughly dry the parts with a clean absorbent towel to prevent corrosion.

2. At least at quarterly intervals;

• Brush the inside of the cups with mild warm soapy water and use fine steel wool to remove deposits; the cups should then be rinsed in distilled water and thoroughly dried

3. Follow manufacturer's recommendations for preventive maintenance (lubrication).

4. Semiannually, check brushes and replace if worn to ¼ in. (1 in. = 2.54 cm) of the spring. Also semiannually, check the autotransformer brush and replace if worn to ¼ in. of the spring.

5. Record all information relating to preventive maintenance and repair .This information should be cumulative so that a review for each piece of equipment can be scanned quickly for continuing problems, justification information for replacement requests etc.

C. Maintenance of Laminar Air Flow.

1. Turn the UV light on and fan on for 20 minutes before using the hood. **7.** Turn UV off before starting work, but leave fan on

2. UV irradiate for 20 minutes between cell types and strains and when finished
3. Everything going into hood must be swabbed with EtOH including gloved hands
4. Dry media bottles thoroughly if they have been taken out of the water bath (this water is a great source of contamination). Swab with EtOH, especially at the neck and bottom before placing in hood
5. Clean spills of culture or media immediately with EtOH
6. Ideally, hoods should be cleaned thoroughly approximately every 6 weeks, depending on usage. Swab interior with 70% ethanol. Wash the interior of the cabinet with disinfectant/detergent, including inside of glass panels, roof and walls. Swab interior again with 70% ethanol. Replace front panels and UV irradiate for a further 20 minutes.

Incubators

1. Regularly check the temperature and CO2 levels displayed on the incubator and also the CO2 levels of the cylinder, notify room custodiam if temperatures are incorrect or CO2 levels are low
2. Swab gloved hands with EtOH before opening the incubator
3. Dispose of unwanted flasks appropriately ASAP, to minimise clutter and contamination risk (see Risk assessment & SOP 'Disposal of biological wastes')
4. Clean spills of culture or media immediately with 70% ethanol or 'Biocidal ZF' – use the appropriate disinfectant for the biological agents present (e.g. ethanol is insufficient to kill viruses).
5. All cell lines should be inspected regularly for microbial contamination.

Water bath

1. Check the water level (top up with autoclaved water only) and check for any contamination in the waterbath eg. turbidity or fungal growth.
2. Water should be changed monthly (more often if heavy usage). Spray the inside of the bath with 'Biocidal ZF' before refilling with autoclaved water.

Section 4 – **Disposal / Spills / Incidents**

Cell culture liquids must be disposed of by autoclaving, or treated with Virkon or freshly prepared 1% bleach. Anything that has been exposed to cell culture should also be similarly treated. After decontamination by these methods, liquids can then be disposed of via the sink.

1. Do not leave waste media in the tissue culture room and do not over fill the biohazard bag. When the bag is 2/3 full, tie and take to be autoclaved on Level 2. Please replace the bag immediately!
2. Any spills must be cleaned up immediately. Depending on the nature of the spill, clean up as described in SOPs for Biohazard Spills, Flammables, Corrosives, or Toxic Substances.
3. Any large spills of hazardous materials (>1L) or incidents resulting in injury must be

reported to your supervisor immediately and via the online incident report form within 24 h.

Maintenance of Fume hood

Air Velocity • Keep the sash fully open and the cabinet empty.

• Check the air velocity with a thermoanemo meter (minimum acceptable face velocity, 100 ft (1ft = 30.48cm)/min. Smoke containment

• A smoke containment test should be performed with the cabinet empty to verify proper directional face velocity.

Lubrication • Lubricate the sash guides as needed.

Maintenance of the Biological Safety Cabinet

Routine *ƒ* After each use, disinfect the work area. Since UV radiation has very limited penetrating power, do not depend on UV irradiation to decontaminate the work surface. Clean UV lamps (in the off position) with 70% isopropyl or ethyl alcohol, at least once a week. Periodic checks *ƒ* Have class 1 biological safety cabinets certified at least annually.

ƒ They should also be certified after installation but before use and after they have been relocated or moved. *ƒ* Certification should include the following and will be documented by the trained company representative. (Contracted to handle the biological safety cabinet inspection).

A. Air Velocity

• Measurements of the air velocity will be taken at the midpoint height approximately 1 inch behind the front opening. Measurement should be made at approximately every 6 inch.

• The average face velocity should be at least 75 linear ft / min.

B. Smoke containment

• With the cabinet containing the routine work items, such as Bunsen burner, test tube rack, bacteriological loop and holder, etc., a smoke containment test should be performed to determine the proper directional velocity.

C. Record the date of re- certification, the names of the individual and company re-certifying the cabinet, and any recommendations for future service. Any maintenance performed should also be documented in writing.

Maintenance of autoclaves Daily

1. Remove the outlet screen and clean with detergent and a brush under running water.
2. Clean the chamber using a cloth. Do not use abrasive cleansers or steel wool, as these will scratch the surface and increase corrosion.
3. Clean the door or lid gaskets with a cloth and check for defects. Replace defective gaskets.
4. Clean the shelves in the autoclave or the basket or cart that holds packs (including the wheels of the cart) with detergent and a cloth.

List of laboratory instruments in Botany Department

SN	NAME OF INSTRUMENT	MAKE & MODEL	QUANTITY	REMARK
1.	Digital pH meter	Systronics	1	Work
2.	Incubator	NSW-150 NSW 151 Bacteriological incubator	3	Work
3.	Vertical Autoclave	NSW	1	Work
4.	Centrifuge	1. Remi model R-24 2. Remi model R-4C	2	Work
5.	Spectrophotometer	Double beam 2203 Systronics	1	Work
6.	Hot Air Oven	1. NSW-143 2. Labfit 3 .Optics technology	3	Work Work Not work
7.	Laminar Air Flow	1. Intech 2.Ecofriendly 3.NSW	3	Work
8.	Digital Photocolorimeter	EI model 321	1	Work
9.	Hot plate magnetic strrer	Genei	1	Work
10	Shaking Incubator	NSW-159	1	Not Work
11	Water Bath	1. NSW-125 2.NSW-	2	Work
12	Hot Plate	JSGW	1	Work
13	Water Distillation Unit	1.Aluminium set 2.Glass set	2	Work
14	Vortexer	Genei	1	Work
15	Digital Colony Counter	Zenith	1	Work
16	Digital Balance	1.Aczel model-CG203-L 2.Citizon model- MP3000 3.Shimadzu	3	Work Work Not work
17	Micro Pipette	Tarsons- T1000,T100,T10,T2	1	Work
18	Electrophoresis	Techno source	1	Work
19	Digital Polorimeter	Systronics	1	Work
20	Alcometer	-	1	Work
21	Hydrometer	Brix thermo	2	Work
22	Clevenger Apparatus	Brosil	5	Work
23	Soxhlet Extractor	Brosil	2	Work
24	Camera Lucida		1	Work
25	Deciceator plain	Tarsons	3	Work
26	Thermometer		3	Work
27	Microscope-		10	Work
	1.Simple microscope	Micron optics, Meswox	25	Work
	2.Monocular Light			
	microscope	Labomed	15	Work
	3.Binocular Light			
	Microscope	Labomed	1	Work
	4.Stereo Microscope			

Food Science and Technology

LAB INSTRUCTIONS & STANDARD OPRATING PROCEDURE

NAME OF INSTRUMENT	BAKING OVEN
MAKE AND MODEL	SWAN SCIENTIFIC
DATE OF PURCHASED	17/09/2015

PROCEDURE:

1. CONNECT THE POWER CABLE OF THE OVEN TO THE POWER OUTLET.
2. ENSURE THAT THE TEMPERATURE ACTING POTENTIOMETER IS SET TO A MINIMUM.
3. SWITCH THE ON/OFF KEY TO THE 'ON' POSITION.
4. ADJUST THE TEMPERATURE SETTING POTENTIOMETER TO SET THE DESIRED TEMPERATURE.
5. WAIT UNTIL THE ORANGE INDICATOR LAMP STARTS FLASHING CONTINUOUSLY AND THE TELETHERMOMETER IS INDICATING THE DESIRED PERIOD OF TIME.
6. CLOSE OVEN DOOR AND LEAVE ITEMS INSIDE FOR THE DESIRED PERIOD OF TIME.
7. REMOVE THE ITEMS FROM THE OVEN, ONCE THE DESIRED PERIOD OF TIME HAS ELAPSED.
8. SET THE TEMPERATURE SETTING POTENTIOMETER TO A MINIMUM.
9. SWITCH THE ON/OFF KEY TO THE OFF POSITION.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	LUG-CAP SEALING MACHINE
MAKE AND MODEL	IKON
DATE OF PURCHASED	30/07/2015

OPERATIONAL PROCEDURE:

1. CHECK THAT SEALING MACHINE IS CLEANED PROPERLY. IF NOT SATISFACTORY CLEAN IT WITH DRY LINT FREE CLOTH.
2. AFFIX THE DIE AS PER THE CAP SIZE AND MAINTAIN THE HEIGHT OF THE BASE PLATE ACCORDING TO THE BOTTLE HEIGHT WITH THE SCREW BELOW THE BASE PLATE.
3. PUT THE BOTTLE ON THE CENTRE OF THE BASE PLATE OF THE MACHINE.
4. SWITCH 'ON' THE MACHINE.
5. PUSH THE PADDLE TO START THE CAP SEALING AND THREAD THE CAP WITH SEALING ROLLERS BY COMING DOWNWARD.
6. AFTER SEALING OF THE CAP OF THE BOTTLE, REPLACE IT WITH ANOTHER BOTTLE AND CONTINUE THE PROCESS.
7. AFTER COMPLETION OF THE SEALING OPERATION, CLEAN THE MACHINE.

CLEANING PROCEDURE:

1. AFFIX ''TO BE CLEANED LABEL''.

2. DISMANTLE THE DIE FROM THE CENTRAL ROD, SEALING ROLLERS, SPRINGS AND OTHER PARTS AS SOON AS THE COMPLETION OF THE CAP SEALING OPERATION.

3. WASH ALL THE PARTS WITH 0.1% TEEPOL SOLUTION, THEN WASH IT WITH TAP WATER AND CLEAN IT WITH DRY CLOTH.

4. CLEAN THE UPPER PART OF THE MACHINE CONTAINING MOTOR AND GEARBOX WITH DRY CLOTH.

5. WASH THE LOWER PART OF THE MACHINE LIKE BOTTLE BASE PLATES WITH 0.1% TEEPOL SOLUTION AND DRY WITH DRY LINT FREE CLOTH.

6. AFFIX THE 'CLEAN' LABEL AND COVER IT.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	CENTRIFUGE
MAKE AND MODEL	MERK BIOSCIENCE
DATE OF PURCHASED	31/07/2015

PROCEDURE:

1. BEFORE USING CENTRIFUGE CHECK TO SEE OPPOSITE TERMINAL RING'S AND SHIELDS ARE OF THE SAME WEIGHT. THIS CAN BE DONE EASILY SINCE THE WEIGHTS ARE INSCRIBED ON THE TERMINAL RINGS SHIELDS.
2. CHECK THAT THE SHIELDS CONTAIN RUBBER CUSHIONS.
3. CHECK THAT OPPOSING SETS OF TERMINAL RINGS AND SHIELDS BALANCE EACH OTHER.
4. PLACE EXPERIMENTAL SAMPLE INTO THE CENTRIFUGE TUBE AND BALANCE IT AGAINST ANOTHER WATER BALANCE TUBE USING THE BEAM BALANCE AND SQUIRT BOTTLE.
5. PLACE INTO TERMINAL RINGS POSITIONING BALANCED TUBES OPPOSITE TO ONE ANOTHER.
6. ONCE TUBES ARE IN PLACE AND ALL ROTOR POSITIONS ARE FILLED. CLOSE THE LID OF CENTRIFUGE.
7. SET THE DESIRED TIME ON TIMER.
8. SELECT APPROPRIATE SPEED SETTING ON CENTRIFUGE WITH THE SPEED SELECTION KNOB. THIS SIMULTANEOUSLY TURNS ON THE CENTRIFUGE.
9. ONCE CENTRIFUGE IS TURNED ON, LID MUST BE KEPT CLOSED.
10. DO NOT RE-OPEN IT UNTIL IT COMES TO A COMPLETE STOP AT END OF RUN.
11. THEN CENTRIFUGE HAS STOPPED.
12. CAREFULLY REMOVE TUBES WITHOUT AGITATING CONTENTS.
13. CLOSE THE LID OF CENTRIFUGE.
14. PROPERLY DISPOSE OF ANY WASTE MATERIAL DISPOSABLE BIN AND CLEAN UP THE AREA AROUND THE CENTRIFUGE

STANDARD OPERATING PROCEDURE OF COBB TESTER

NAME OF INSTRUMENT	COBB TESTER
MAKE AND MODEL	OPTICS TECHNOLOGY
DATE OF PURCHASED	09/12/2017

PROCEDURE

1. A SAMPLE IS TAKEN. NOW WEIGH IT TO NEAREST 0.1 GRAM.
2. NOW TAKE A CORK SHEET ON THE METAL PLATE AND THEN PLACE THE WEIGHED SPECIMEN ON IT AND CLAMP THE SPECIMEN FIRMLY TO PREVENT ANY KIND OF LEAKAGE BETWEEN THE SAMPLE AND THE RING.
3. USE SOFT ELASTIC AND NON – ABSORBENT GASKET TO ENSURE LEAK – FREE CLAMPING BETWEEN THE RING AND THE UPPER SURFACE OF THE SAMPLE DURING THE TEST.
4. NOW POUR WATER INTO THE FIXTURE AS PER REQUIREMENT OF THE SAMPLE.
5. LET THE SAMPLE INSIDE THE CYLINDRICAL RING FOR 120 SECONDS.
6. NOW WITH THE HELP OF HAND ROLLER DRAIN OUT THE EXCESS WATER FROM THE SAMPLE WITHOUT EXERTING ANY PRESSURE AND ROTATING THE ROLLER IN TO AND FORTH WAY.
7. NOW AGAIN WEIGH THE SAMPLE.
8. FORMULA TO CALCULATE COBB VALUE

COB VALUE = WEIGHT OF THE SAMPLE AFTER TESTING - WEIGHT OF THE SAMPLE BEFORE TESTING

*IF ANY LIQUID IS PASSED THROUGH THE SHEET TO THE RUBBER MAT, THE TEST WILL BE REJECTED

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	FLUIDISED BED DRIER
MAKE AND MODEL	SWAN SCIENTIFIC
DATE OF PURCHASED	17/09/2015

PROCEDURE

1. Production person shall ensure the cleanliness of the Fluidised Bed Dryer, its part & area and 'CLEANED'label on it.
2. Check proper fixing of finger bags, retarding chamber and bowl.
3. Before starting the operation production person get the line clearance from Q. A person and affix the status label with Product Name, Batch Details to equipment & area.
4. Adjust the FBD bowl under the retarding chamber.
5. Put '0n' the mains.
6. Check the pressure in proper in pressure indicating switch i.e. 0.210 to 0.250 kg/cm2 for panel pressure & 2.0 to 2.60 kg/cm^2 for inflatable tube. Pressure indicating switch show a green colour. Main screen display in Human Machine Interface. Then press login switch and enter the password 1, 2, 3 and 4. The main screen will show with manual & auto mode.
7. For manual mode- press two times 'Manual' and then press 'manual action', a green indicator will glow on top of the screen.
8. Main screen shows in front with finger bagseal, FBD bowl seal then press for FBD bag sealing after this press for FBD bowl sealing.
9. After this press 'Next' again screen with inlet temperature, product temperature and outlet temperature indicating. Set all parameter according to Batch Manufacturing Record and then open the inlet damper between 10 - 90% as per product.
10. Then press 'PREVIOUS 'in screen and finally press exhaust blower and start the drier for 2 minute.
11. Keep the damper of air inlet and outlet at pre-decided positions and adjust timer as per batch.

STANDARD OPERATING PROCEDURE

NAME OF UNSTRUMENT	HOT AIR OVEN
MAKE AND MODEL	VORCO
DATE OF PURCHASE	01/08/2015

AIM: TO LAY DOWN THE PROCEDURE FOR OPERATION OF HOT AIR OVEN.

PROCEDURE:

A. INSPECT THE OVEN

1. MAKE SURE THE ELECTRIC POWER CONNECTIONS ARE MADE CORRECTLY AND THAT THE POWER CABLE IS NOT DAMAGED.
2. MAKE SURE THAT THE AREA AROUND THE OVEN IS CLEAR. THE OVEN SHOULD HAVE 6 INCHES CLEARANCE AROUND IT.
3. INSPECT THE INSIDE OF THE OVEN TO MAKE SURE IT IS CLEAN AND THAT NO ONE HAS LEFT THEIR SPECIMEN OR FIXTURES IN IT.

B. START HEATING

1. TURN ON THE OVEN BY PRESSING THE MAIN POWER SWITCH IN THE LOWER RIGHT. THE CONTROLLER WILL PERFORM A BRIEF SELF TEST DURING WHICH THE DISPLAY SHOWS.
2. PRESS AND HOLD THE X OR X BUTTONS TO INCREASE AND DECREASE THE TEMPERATURE IS TO SET THE POINT.

C. LOAD THE SPECIMEN

1. BEFORE YOU PUT ANYTHING IN THE OVEN MAKE SURE IT IS SAFE TO HEAT THIS PART TO THE DESIRED TEMPERATURE.
2. MAKE SURE YOU HAVE EVERYTHING YOU ARE GOING TO NEED I.E. SAFETY EQUIPMENTS, TOOLS ETC.
3. MAKE SURE THERE IS A CLEAR AND SAFE PLACE TO PUT THE PART WHEN YOU EVENTUALLY TAKE IT OUT.
4. PROTECTIVE EQUIPMENTS SUCH AS GLOVES, APRONS ARE AVAILABLE AND LOCATED NEAR THE OVEN.
5. OPEN THE OVEN STORE. THE POWER TO THE HEATING ELEMENTS IS AUTOMATICALLY TURNED OFF.
6. LOAD YOUR SPECIMEN. MAKE SURE IT IS NOT TOUCHING THE HEATING ELEMENTS OR ELECTRIC SHORT MIGHT OCCUR WHEN YOU CLOSE THE DOOR.
7. CLOSE THE DOOR.
8. CLEAN UP THE AREA AROUND THE OVEN AND STORE THE PROTECTIVE EQUIPMENTS.

D. REMOVING THE SPECIMEN

1. PROTECTIVE MATERIAL'S TEMPERATURE
2. OPEN THE OVEN STORE.
3. REMOVE YOUR SPECIMEN CAREFULLY. PLACE IT ON A HEAT RESISTANT SURFACE.
4. CLOSE THE DOOR.
5. CLEAN UP THE AREA AROUND THE OVEN AND STORE THE PROTECTIVE EQUIPMENT PROPERLY.

E. FINISHING UP

1. TURN OFF THE OVEN.
2. CLEAN UP THE AREA INSIDE THE OVEN.
3. PUT ALL TOOLS AND PROTECTIVE EQUIPMENTS BACK IN THEIR PROPER PLACES.
4. REMOVE YOUR OVEN IN USE AND DISPLACE OF IT.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	INCUBATOR
MAKE AND MODEL	MERK BIOSCIENCE
DATE OF PURCHASED	08/09/2015

GENERAL CLEANING PROCEDURE:

1. ENSURE THAT THE POWER SUPPLY TO THE INCUBATOR IS SWITCHED OFF.
2. DE-DUST THE INCUBATOR DAILY EXTERNALLY WITH A CLEAN DRY CLOTH.
3. ONCE IN A WEEK REMOVE ADHERED DUST BY WET MOPPING USING SOAP SOLUTION. AFTERWARD, WIPE THE SURFACE WITH A CLEAN DRY CLOTH TO REMOVE THE MOISTURE.
4. MOP THE INTERIOR SURFACES WITH A CLEAN DRY CLOTH, DAILY.

OPERATING PROCEDURE:

1. ENSURE THAT THE INCUBATOR IS PROPERLY CONNECTED TO THE POWER SUPPLY.
2. SWITCH ‘ON’ THE MAIN SWITCH AND THEN THE CABINET SWITCH.
3. SET THE REQUIRED TEMPERATURE BY PRESSING THE ‘SET KNOB ‘AND

SOFT KEYS.

4. MONITOR THE TEMPERATURE DAILY AS PER FOLLOWING PROCEDURE.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	MAGNETIC STIRRER
MAKE AND MODEL	MERK BIOSCIENCE
DATE OF PURCHASED	31/07/2015

AIM: TO LAY DOWN THE PROCEDURE FOR MAGNETIC STIRRER.

PROCEDURE:

A. MAINTENANCE AND USAGE RECOMMENDATIONS

1. MAGNETIC STIRRER SHOULD BE USED ON LEVEL SURFACES.
2. IF HAZARDOUS VAPORS WILL NOT BE PRODUCED, HOT PLATES SHOULD BE IN AN AREA FREE OF DRAFTS TO ENSURE HEATING EFFICIENCY.
3. KEEP THE TOP SURFACE OF THE MAGNETIC STIRRER CLEAN. USE A NON-ABRASIVE CLEANER TO CLEAN THE SURFACE AND THE OUTSIDE OF THE UNIT.
4. REPLACE THE TOP SURFACE IF DAMAGE.
5. MAINTAIN THE INSTRUMENT LOGBOOK, CONTAINING THIS SOP, TEMPERATURE CONTROL RECORD AND/OR MAINTENANCE REPAIR LOGS, AND ASSOCIATED INSTRUCTION MANUALS IN THE IMMEDIATE VICINITY OF THE INSTRUMENT.

B. MAGNETIC STIRRER OPERATION

1. STIR BAR SHOULD BE PLACED IN THE SAMPLE VESSEL PRIOR TO MIXING.
2. PLACE THE VESSEL ON THE STIRRER SO THAT IT IS CENTERED. FOR STIRRERS WITH MULTIPLE STIRRING BLOCKS, CENTRE THE SAMPLE VESSEL OVER A STIRRING BLOCK.
3. TURN THE INSTRUMENT ON (REFER TO INSTRUCTION MANUAL FOR INSTRUMENT-SPECIFIC PROCEDURES).
4. SET THE STIRRING SPEED (REFER TO INSTRUCTION MANUAL FOR INSTRUMENT-SPECIFIC PROCEDURES).
5. NOTE THAT THE STIRRING SPEED WILL BE AFFECTED BY LIQUID VISCOSITY, THE SIZE OF THE STIR BAR, VESSEL SIZE, AND THICKNESS OF VESSEL BOTTOM.
6. WHEN STIRRING IS COMPLETE, TURN MAGNETIC STIRRER OFF AND REMOVE SAMPLE.

STANDARD OPRATING PPROCEDURE

NAME OF INSTRUMENT PADDY HUSKER
MAKE AND MODEL

PROCEDURE:

1. SWITCH ON THE INSTRUMENT.

2. POUR PADDY 2KG FROM PADDY RECEIVER.

3. LET DE-HUSKING DONE FOR FIVE MINUTES.
4. SWITCH OFF THE INSTRUMENT.

5. OPEN THE DOOR AND TAKE OUT THE BROWN RICE.

6. HUSK GETS ASPIRATED OFF.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	MILK PASTURIZER
MAKE AND MODEL	DAIRY TECH
DATE OF PURCHASE	06/03/2017

PROCEDURE:

1. POUR THE COOL RAW MILK THROUGH THE FLOAT TANK.
2. THEN IT WILL FLOW THROUGH THE HEAT EXCHANGER CALLED RE-GENERATOR.
3. THEN NOW WARMED MILK PASSES THROUGH A PRE-HEATER.
4. NOW THE MILK ENTERS THE PASTEURIZING LOOP AT THE TEMPERATURE OF 72^{O} C FOR 20 SECONDS (63 DEGREE FOR 30 MIN.)
5. ONCE IT HAS BEEN SUCCESSFULLY PASTEURIZED IT FLOW INTO THE SEPARATOR.
6. A REFRIGERATION UNIT CHILLS IT TO ITS FINAL TEMPERATURE.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	PLANETARY MIXTURE
MAKE AND MODEL	IKON
DATE OF PURCHASED	02/09/2015

OBJECTIVE

TO LAY DOWN THE PROCEDURE OF OPERATION OF PLANETARY MIXTURE WITH WORKING CAPACITY OF 3-3.5 KG

RESPONSIBILITY

EXECUTION: STUDENT

CHECKING: FACULTY /LAB OFFICER

PROCEDURE

1. EXAMINE THE MACHINE PART FOR CLEANLINESS AND FIT ALL THE MACHINE PARTS PROPERLY.
2. POWDER AND EXCIPIENT ARE TAKEN IN THE MIXING BOWL.
3. CONNECT THE MACHINE TO THE MAIN SUPPLY.
4. PRESS START BUTTON LOCATED IN THE MACHINE.
5. MIXING BLADE START TO ROTATE AROUND ITSELF AS WELL AS TRAVEL IN THE BOWL THERE BY ACHIEVING INTIMATE MIXING.
6. DURING THIS PROCESS TEFLON SCRAPER ADJUSTED TO APPLY LIGHT PRESSURE TO THE WALL OF THE VESSEL CONTINUOUSLY WHICH REMOVES ANY PRODUCT ADHERING TO THE SIDE OF THE WALL BOWL.
7. PRESS STOP AFTER COMPLETING OF OPERATION

CLEANING

THE APPARATUS SHOULD BE CLEANED BEFORE AND AFTER USE AND STUDENTS SHOULD ENSURE THE CLEANLINESS OF THE MACHINE AREA AND ‘CLEANED’ LABEL ON IT.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	PULPER
MAKE AND MODEL	IKON
DATE OF PURCHASED	30/07/2015

PROCEDURE

1. SWITCH ON THE INSTRUMENT.
2. POUR PREPARED FRUIT FROM THE RECEIVER.
3. THE GRINDED PULP IS COLLECTED FROM THE OUTLET.
4. SWITCH OFF THE INSTRUMENT

STANDERD OPRATING PROCEDURE

NAME OF INSTRUMENT	RICE POLISHER
MAKE AND MODEL	IK-711
DATE OF PURCHASED	02/09/2015

PROCEDURE

1. SWITCH ON THE INSTRUMENT.
2. POUR BROWN RICE FROM RECEIVER.
3. LET POLISHING DONE FOR FIVE MINUTES.
4. SWITCH OFF THE INSTRUMENT.
5. OPEN THE DOOR AND TAKE OUT THE POLISHED RICE.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	ROTARY SHAKER INCUBATOR
MAKE AND MODEL	MERK BIOSCIENCE
DATE OF PURCHASED	08/09/2015

AIM: TO LAY DOWN THE PROCEDURE FOR HOT PLATE.

PROCEDURE:

A. PRE-ANALYSIS CHECKLIST

1. MAKE SURE YOU HAVE YOUR REQUIRED SAFETY EQUIPMENT OF GLASSES, CLOSED TOE SHOES, GLOVES, AND LABORATORY COAT.
2. CHECK THE MACHINE FOR ANY PREVIOUS SAMPLES LEFT INSIDE.
3. REMOVE ANY DUST OR OTHER FOREIGN OBJECTS FROM THE INCUBATOR PLATFORM WITH A SOFT TOWEL OR CLOTH.
4. MAKE SURE THE MACHINE IS PLUGGED IN.

B. EQUIPMENT OPERATION LOADING THE SHAKER

1. PUT YOUR SAMPLE MATERIAL IN AN ACCEPTABLE CONTAINER WITH A LID.
2. GENTLY PRESS THE CONTAINER IN ONE OF THE SPRING HOUSINGS UNTIL IT IS SECURELY IN PLACE.

C. SHAKER OPERATION

1. CLOSE THE LID OF THE INCUBATOR AND TURN ON THE MACHINE USING THE POWER SWITCH TO THE RIGHT HAND SIDE. THE LED DISPLAY WILL MOMENTARILY SHOW THE MODEL NUMBER. (NOTE: THE SHAKER WILL NOT OPERATE OF THE LID IS OPEN)
2. ONCE THE MACHINE IS POWERED ON, THE INCUBATOR MAY START RUNNING. PRESSING THE START/STOP BUTTON WILL CAUSE THE SHAKING TO STOP.
3. PRESS THE SELECT BUTTON UNTIL THE RPM INDICATOR IS ILLUMINATED ON THE LEFT HAND SIDE OF THE CONTROL PANEL.
4. USE THE ARROW KEYS TO SET THE RPM OF THE SHAKER. A VALUE FROM 50 TO 400 RPM IS AVAILABLE. THE NUMBER WILL SET WHEN NO BUTTONS ARE PRESSED.
5. PRESS THE SELECT KEY UNTIL THE ºC INDICATOR ILLUMINATES.
6. SET THE TEMPERATURE USING THE ARROW KEYS. TEMPERATURE RANGE IS FROM 4º TO 60ºC
7. PRESS THE SELECT KEY UNTIL THE HRS INDICATOR IS ILLUMINATED.
8. USE THE ARROW KEYS TO SET THE TIME OF THE SHAKER. THIS CAN BE A VALUE FROM .1 TO 99.9. THE NUMBER WILL SET WHEN NO BUTTONS ARE PRESSED. IF A CONTINUOUS RUN TIME IS DESIRED, SIMPLY PRESS THE START STOP BUTTON.
9. PRESS THE START/STOP KEY. THE SHAKER WILL START IN UNTIMED MODE.

10. PRESS THE START/STOP KEY AGAIN. THE SHAKER WILL STOP AND THE DISPLAY WILL READ OFF.
11. PRESS THE START/STOP KEY A THIRD TIME; THE TIME INDICATOR WILL LIGHT AND THE SHAKER WILL NOW START THE TIMED RUN.
12. THE MACHINE WILL COME TO A STOP ONCE THE TIMED RUN HAS ENDED. IF RUNNING IN UNTIMED MODE, THE START/STOP KEY CAN BE PRESSED AT ANY DESIRED TIME.

D. MACHINE SHUTDOWN

1. MAKE SURE THE MACHINE HAS COME TO A COMPLETE STOP AND OPEN THE LID.
2. REMOVE ANY SAMPLES YOU NEED. USE A HOT GLOVE IF HIGH TEMPERATURES WERE SET.
3. TURN OFF THE POWER BY FLIPPING THE SWITCH ON THE RIGHT SIDE OF THE MACHINE

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	SOXHLET APPRATUS
MAKE AND MODEL	JAGUAR INSTRUMENT TECHNOLOGY

PROCEDURE:

1. ASSEMBLE THE APPARATUS.
2. FILL THE ROUND BOTTOM FLASK WITH SOLVENT (N-HEXANE).
3. PUT THE THIMBLE CONTAINING SAMPLE INTO EXTRACTION TUBE.
4. ATTACH THE EXTRACTION TUBE WITH FLASK CONTAINING SOLVENT.
5. ATTACH A CONDENSER UNIT WITH THE EXTRACTION TUBE AND RUN THE WATER.
6. FIX THE SOXHLET APPARATUS ON HOT PLATE AND HEAT THE FLASK CONTAINING SOLVENT.
7. THE SOLVENT STARTS TO EVAPORATE AND FALLS IN THE EXTRACTION TUBE AFTER CONDENSING.
8. CONTINUE THIS PROCESS TILL ALL THE FAT IS EXTRACTED.
9. DISCONTINUE THE PROCESS AND TAKE OUT THE THIMBLE.
10. AGAIN ATTACH THE EXTRACTION TUBE WITH FLASK CONTAINING SOLVENT ALONG WITH FAT AND CONDENSER UNIT.
11. AGAIN HEAT THE FLASK TO RECOVER THE SOLVENT.
12. DISCONTINUE THE PROCESS AND CLEAN THE EXTRACTION TUBE AND THIMBLE.

STANDARD OPERATING PROCEDURE

NAME ON INSTRUMENT	SPECTROPHOTOMETER
MAKE AND MODEL	SYSTRONIC
DATE OF PURCHASED	07/08/2015

PROCEDURE:

1. CAREFULLY CLEAN THE SAMPLE HOLDER, ESPECIALLY AFTER USING CORROSIVE OR SALT SOLUTION.
2. MOP UP ANY SPILT LIQUID AND BRUSH ANY SPILT CHEMICAL FROM THE SPECTROPHOTOMETER AND ADJACENT AREAS.
3. WASH THE CUVETTES IMMEDIATELY AFTER USE. RINSE THE CUVETTES WITH DEIONISED WATER AT LEAST 3 TIMES, ALLOW THEM TO DRAIN AND DRY THEM INVERTED

SAFETY CHECKS:

1. CHECK THAT ELECTRICAL CONNECTIONS ARE FULLY COUPLED THAT CORDS ARE NOT FRAYED AND THAT THERE IS NO LIQUID ON OR ABOUT THE SPECTROPHOTOMETER.
2. UNIDENTIFIED SPILT CHEMICALS SHOULD BE REMOVED WITH EXTREME CAUTION.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	BURSTING STRENGTH TESTER
MAKE AND MODEL	OPTICS TECHNOLOGY
DATE OF PURCHASED	04/10/2016

PROCEDURE

1. ENSURE THAT THE CONNECTION OF ELECTRIC SUPPLY IS PROPERLY CONNECTED.
2. SWITCH ON MAINS. THIS WILL BRING THE PLUNGER TO ITS STARTING POSITION (PLEASE NOTE THAT IF THE PLUNGER IS ALREADY AT ITS STARTING POSITION, MOTOR WILL NOT START ON SWITCHING ON MAINS).
3. RAISE THE WHEEL BY ROTATING IT IN ANTICLOCKWISE DIRECTION AND FIT IT INTO DIAPHRAGM BY ROTATING IT IN CLOCKWISE DIRECTION.
4. CUT THE PIECE OF REPRESENTATIVE SAMPLE IN A SIZE, IN SUCH A WAY THAT IT SHOULD BE PROPERLY FITTED BETWEEN THE DIAPHRAGM AND WHEEL.
5. SET THE RED POINT OF THE GAUGE AT ‘ZERO’ POSITION BEFORE

BURSTING THE REPRESENTATIVE SAMPLE.

6. PRESS THE RED SWITCH TILL THE REPRESENTATIVE SAMPLE BURST. AFTER RELEASING THE PRESSURE OVER THE RED SWITCH THE PLUNGER WILL RETAIN ITS ORIGINAL PLACE.
7. NOTE DOWN THE BURSTING PRESSURE [STRENGTH] INDICATED BY THE RED POINTER ON THE GAUGE.
8. REARRANGE THE RED POINTER BY ROTATING THE KNOB PROVIDED ON THE DIAL OF PRESSURE GAUGE AT ITS ORIGINAL PLACE TO SEE THE BURSTING STRENGTH OF OTHER REPRESENTATIVE SAMPLE.

STANDARD OPERATING PROCEDURE

NAME OF UNSTRUMENT	TRAY DRAYER
MAKE AND MODEL	YORCO
DATE OF PURCHASE	01/08/2015

A. OPERATION

1. BEFORE OPERATION THE TRAY DRYER, ENSURE THAT IT IS CLEAN.
2. ENSURE THAT MAIN SWITCH IS OFF.
3. LOAD THE MATERIAL TO BE DRIED IN THE TRAY. CLOSE THE DOOR OF THE TRAY DRYER.
4. SWITCH ON THE MAINS. SET THE DESIRED TEMPERATURE AS PER BMR (BATCH MANUFACTURING RECORD).
5. START THE BLOWER AND THEN START THE HEATER.

B. CLEANING

1. REMOVE ALL THE TRAYS AND TAKE IN WASHING AREA FOR WASHING.
2. DRY ALL THE TRAYS WITH CLEAN DRY LINT – FREE CLOTH.
3. SWITCH OFF THE ELECTRICAL MAINS OF TRAY DRYER BEFORE CLEANING.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	VACCUME PACKAGING UNIT
MAKE AND MODEL	IKON
DATW OF PURCHASED	30/07/2015

PROCEDURE

1. CLEAN AND PREPARE THE FOOD THAT YOU WISH TO VACUUM PACK.
2. PLACE THE FOOD INSIDE THE PLASTIC BAG.
3. PUT THE OPEN EDGE OF THE BAG INTO THE SEALING MACHINE.
4. PRESS THE BUTTON, IF NECESSARY, TO START THE VACUUM AND SEALING PROCESS.
5. WATCH AS THE VACUUM PACK FOOD MACHINE WITHDRAWS THE AIR AND THE PLASTIC BAG SHRINKS.
6. WAIT FOR THE MACHINE TO STOP ITS OPERATION WHICH SIGNALING THAT THE PLASTIC BAG HAS PROPERLY BEEN SEALED.
7. REMOVE THE VACUUM PACKED FOOD AND STORE IT IN THE PANTRY, FRIDGE OR FREEZER.

STANDARD OPERATING PROCEDURE

NAME OF INSTRUMENT	WEIGHING BALANCE
MAKE AND MODEL	SHIMADZU CORPORATION
DATE OF PURCHASE	07/08/2015

A. PROCEDURE

1. CLEAN YOUR HAND BEFORE USING THE WEIGHING BALANCE
2. CLEAN THE CONTAINER & WIPE

B. BASIC WEIGHING FUNCTION

1. TURN ON THE BALANCE SCALE
2. PLACE CONTAINER ON BALANCE
3. TARE THE BALANCE
4. PLACE THE SAMPLE IN CONTAINER & NOTE DOWN THE WEIGHT

DEPARTMENT OF CHEMISTRY

General Laboratory Safety Procedures

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

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

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

Safety Data Sheets

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

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

❖ Proper and safe measurement should be taken for storing and handing of the chemicals used in the laboratory should be maintained.

- Flammable/Combustible Liquids
- Flammable Solids
- Inorganic Acids
- Organic Acids
- Oxidizing Acids (Nitric, etc.)
- Caustics (Bases)
- Oxidizers
- Water Reactives
- Air Reactives
- Unstable (shock-sensitive, explosive)
- Carcinogens & Reproductive Toxins
- Toxins, Poisons
- Non-Toxics
- Compressed Gases
- Gases: Toxic Gases, Flammable Gases, Oxidizing Gases, Corrosive Gases, Inert Gases
- Cryogenic Liquids
-

A. Chemical Fume Hoods – Procedures for Proper and Safe Use

❖ A chemical fume hood must be used for any chemical procedures that have the potential of creating:

❖ Airborne chemical concentrations that might approach Permissible Exposure Limits (PELs) for an Occupational Safety and Health Administration (OSHA) regulated substance. These substances include carcinogens, mutagens, teratogens, and other toxics.

❖ Flammable/combustible vapors approaching one tenth the lower explosive limit (LEL). The LEL is the minimum concentration (percent by volume) of the fuel (vapor) in air at which a flame is propagated when an ignition source is present.

❖ Explosion or fire hazards.

❖ Odors that are annoying to personnel within the laboratory or adjacent laboratory/office units.

❖ Hoods must be closed when unattended.

❖ The sash opening must be positioned no higher than the operating height (or half open) when the hood is being used with chemicals present or when chemical manipulations are performed. When working with hazardous chemicals, the hood sash should always be

positioned so that it acts as a protective barrier between laboratory personnel and the chemicals.

- The set-up position (fully open) is only used to place equipment in the hood when no chemicals are present. Do not fully open the sash when chemicals are present.
- Sliding horizontal sash panels are used with one panel placed in front of the face and arms reaching around the sides to perform manipulations. Do not slide the panels laterally exposing the face to the interior of the hood with chemicals present.
- Hood baffles or slots should be positioned properly if available.
- Equipment should be placed in the center of the working surface in the hood. Do not place materials at the front or back of the working surface. Separate and elevate equipment by using blocks or lab jacks to ensure that air can flow easily around and under the equipment.
- Chemical fume hoods must be kept clean and free from unnecessary items and debris at all times. Solid material (paper, tissue, aluminum foil, etc.) must be kept from obstructing the rear baffles and from entering the exhaust ducts of the hood.
- Minimize the amount of bottles, beakers and equipment used and stored inside the hood because these items interfere with the airflow across the work surface of the hood
- Sliding horizontal sash windows must not be removed from the hood sash.
- Laboratory personnel must not extend their head inside the hood when operations are in progress.
- The hood must not be used for waste disposal (evaporation).
- Hoods must be monitored by the user to ensure that air is moving into the hood.
- Perchloric acid digestions and other procedures using perchloric acid at elevated temperatures must not be performed in standard chemical fume hoods. Specially designed perchloric acid fume hoods must be utilized for this purpose.

B. Corrosive Chemicals – Procedures for Safe Handling and storage

Appropriate personal protective equipment (e.g., gloves, fire-resistant or all cotton lab coat, and safety goggles) must be worn when working with corrosive chemicals. A face shield, rubber apron, and rubber booties may also be appropriate depending on the work performed.

- Appropriate protective gloves that are resistant to permeation or penetration from corrosive chemicals must be selected and tested for the absence of pin holes prior to use.
- Eyewashes and safety showers must be readily available in areas where corrosive chemicals are used and stored. In the event of skin or eye contact with a corrosive chemical, the affected area should be immediately flushed with water for 15 minutes. Contaminated clothing should be removed and medical attention sought.
- Corrosive chemicals should be handled in a fume hood to ensure that any possible hazardous or noxious fumes generated are adequately vented.
- When mixing concentrated acids with water, add the acid slowly to the water. Allow the acid to run down the side of a container and mix slowly to avoid violent reactions and splattering. Never add water to acid.
- Appropriate spill clean-up material should be available in areas where corrosive chemicals are used and stored.
- Protective carriers shall be used when transporting corrosive chemicals.
- Containers and equipment used for storage and processing of corrosive material must be corrosion resistant

- ❖ Corrosive chemicals must be stored below eye level, preferably near the floor to minimize the danger of their falling from cabinets or shelves.
- ❖ Acids and caustics (i.e. bases) must be stored separately from each other. Secondary containers or trays must be used to separate acids and bases or other incompatible corrosives within a corrosive cabinet.
- ❖ Oxidizing acids must be separated from organic acids and flammable/combustible materials (oxidizing acids are particularly reactive with organics and flammable/combustible materials).
- ❖ Acids must be segregated from active metals (e.g., sodium, potassium, and magnesium) and from chemicals that can generate toxic gases (e.g., sodium cyanide and iron sulfide).
- ❖ Corrosive gas cylinders must be returned for disposal every two years.

C. Flammable and Combustible Liquids – Procedures for Safe Handling and Storage

- ❖ Appropriate personal protective equipment (e.g., gloves, fire-resistant or all cotton lab coat, and safety goggles) must be worn when working with flammable/combustible liquids.
- ❖ Flammable/combustible liquids must never be heated using open flames. Preferred heat sources include steam baths, water baths, oil baths, hot air baths, and heating mantels.
- ❖ Ignition sources must be eliminated in areas where flammable vapors may be present.
- ❖ Flammable/combustible liquids should only be dispensed under a fume hood. Ventilation is one of the most effective ways to prevent the formation and concentration of flammable vapors.
- ❖ Flammable/combustible liquids in containers with a volume greater than 1 gallon (3.8 liters) should be transferred to smaller containers that can be easily manipulated by one person.
- ❖ Appropriate fire extinguishers must be available in areas where flammables are used.
- ❖ Flammable/combustible liquid in quantities exceeding a total of 10 gallons (38 liters) within a laboratory must be stored in approved flammable storage cabinets or safety cans.
- ❖ Flammable/combustible liquid stored outside of flammable storage cabinets in the laboratory should be kept to the minimum necessary for the work being done.
- ❖ Containers with a volume greater than 5 gallons (19 liters) shall not be stored in the laboratory
- ❖ Flammable/combustible liquid stored in glass containers shall not exceed 1 gallon (3.8 liters).
- ❖ Flammable storage cabinets and safety cans must not be altered or modified.
- ❖ Safety cans with damaged screens (spark arrestors) or faulty springs (that do not close tightly) do not meet the required specifications of a safety can and must be taken out of service immediately and repaired or replaced.
- ❖ Flammable liquids must only be stored in explosion-proof or laboratory-safe refrigeration equipment.
- ❖ Flammable/combustible liquid containers, filled or empty, must not be stored in hallways or obstructing exits.
- ❖ Bulk waste flammable/combustible liquids should be stored in safety cans.
- ❖ Flammables and combustibles must not be stored near oxidizers, corrosives, combustible material, or near heat sources.

D. Oxidizing Agents – Procedures for Safe Handling and Storage

- Appropriate personal protective equipment (e.g., safety goggles, gloves, fire resistant or all cotton lab coat) must be worn when working with oxidizers.
- If a reaction is potentially explosive or if the reaction is unknown, use a fume hood (with the sash down as a protective barrier), safety shield, or other methods for isolating the material or the process.
- Oxidizers can react violently when in contact with incompatible materials. For this reason, know the reactivity of the material involved in an experimental process. Assure that no extraneous material is in the area where it can become involved in a reaction.
- The quantity of oxidizer used should be the minimum necessary for the procedure. Do not leave excessive amounts of an oxidizer in the vicinity of the process.
- Perchloric acid digestions and other procedures using perchloric acid at elevated temperatures must not be performed in a standard chemical fume hood. A specially designed Perchloric Acid Fume Hood must be utilized for this purpose.
- Oxidizers should be stored in a cool, dry place.
- Oxidizers must be segregated from organic material, flammables, combustibles and strong reducing agents such as zinc, alkaline metals, and formic acid.
- Oxidizing acids such as perchloric acid and nitric acid must be stored separately in compatible secondary containers away from other acids.

E. Reactive Chemicals – Procedures for Safe Handling and Storage

Reactives are substances that have the potential to vigorously polymerize, decompose, condense, or become self-reactive due to shock, pressure, temperature, light, or contact with another material. All reactive hazards involve the release of energy in a quantity or at a rate too great to be dissipated by the immediate environment of the reaction system so that destructive effects occur. Reactive chemicals include:

1) explosives,
2) organic peroxides,
3) water-reactives
4) pyrophorics.

Effective control is essential to minimize the occurrence of reactive chemical hazards.

<u>Explosives:</u>

Appropriate personal protective equipment (e.g., face shield, safety goggles, leather outer gloves, chemical resistant gloves, fire-resistant or all cotton lab coat) must be worn when working with explosives.

- Before working with explosives, understand their chemical properties, know the products of side reactions, know the incompatibility of certain chemicals, and monitor environmental catalysts such as temperature changes.
- Containers should be dated upon receipt and when opened.
- Explosives should be kept to the minimum necessary for the procedure.
- If there is a chance of explosion, use protective barriers (e.g., fume hood sash and safety shield) or other methods for isolating the material or process.
- Explosives should be stored in a cool, dry, and protected area. Segregate from other material that could create a serious risk to life or property should an accident occur.

Organic Peroxides:

- Appropriate personal protective equipment (e.g., safety goggles, gloves, fireresistant or all cotton lab coat) must be worn when working with organic peroxides or peroxide-forming compounds.
- Containers must be labeled with the receiving and opening dates.
- Containers should be airtight, and stored in a cool, dry place away from direct sunlight and segregated from incompatible chemicals.
- Do not refrigerate Peroxide-formers, liquid peroxides, or solutions below the temperature at which the peroxide freezes or precipitates.
- Unused peroxides should never be returned to the stock container.
- Do not use Metal spatulas with peroxide-formers. Use ceramic or plastic spatulas. Contamination by metal can cause explosive decomposition.
- Avoid friction, grinding, and all forms of impact, especially with solid organic peroxides. Never use glass containers with screw cap lids or glass stoppers. Instead, use plastic bottles and sealers.
- Containers with obvious crystal formation around the lid or viscous liquid at the bottom of the container must NOT be opened or moved.
- Organic peroxides produce vapors during decomposition. This can result in pressure build-up. The rapid increase in pressure may cause explosive rupture of containers, vessels or other equipment.
- Ignition sources must be avoided.
- Organic Peroxides have a Self-Accelerating Decomposition Temperature (SADT). Never store organic peroxides where they may be exposed to temperatures above the SADT.

Water-Reactives:

- Appropriate personal protective equipment (e.g., safety goggles, gloves, fireresistant or all cotton lab coat) must be worn when working with water-reactives.
- Water-reactives should be stored under mineral oil in a cool, dry place and isolated from other chemicals.
- Water-reactives must not be stored near water, alcohols, and other compounds containing acidic OH.

In case of fire, keep water away. Appropriate fire extinguishers should be available in areas where water-reactives are used.

F. Compressed Gases – Procedures for Safe Handling and Storage

- Safety glasses with side shields (or safety goggles) and other appropriate personal protective equipment must be worn when working with compressed gases.
- Cylinders must be marked with a label that clearly identifies the contents.
- All cylinders must be checked for damage prior to use. Do not repair damaged cylinders or valves. Damaged or defective cylinders, valves, etc., must be taken out of use immediately and returned to the manufacturer/distributor for repair.
- All gas cylinders (full or empty) must be rigidly secured above the mid line of the cylinder. Only two cylinders per restraint are allowed in the laboratory and only soldered link chains or belts with buckles are acceptable. Cylinder stands are also acceptable but not preferred.
- Handcarts shall be used when moving gas cylinders. Cylinders must be chained to the carts.
- All cylinders must be fitted with safety valve covers before they are moved.

- Only three-wheeled or four-wheeled carts should be used to move cylinders.
- A pressure-regulating device shall be used at all times to control the flow of gas from the cylinder.
- The main cylinder valve shall be the only means by which gas flow is to be shut off. The correct position for the main valve is all the way on or all the way off.
- Cylinder valves must never be lubricated, modified, forced, or tampered. Regulator fittings must not be sealed with Teflon tape, grease or pipe sealant.
- After connecting a cylinder, check for leaks at connections. Periodically check for leaks while the cylinder is in use.
- Regulators and valves must be tightened firmly with the proper size wrench. Do not use adjustable wrenches or pliers because they may damage the nuts.
- Cylinders must not be placed near heat or where they can become part of an electrical circuit.
- Cylinders must not be exposed to temperatures above 50o C (122o F). Some rupture devices on cylinders will release at about 65o C (149o F). Some small cylinders, such as lecture bottles, are not fitted with rupture devices and may explode if exposed to high temperatures.
- Rapid release of a compressed gas must be avoided because it will cause an unsecured gas hose to whip dangerously and also may build up enough static charge to ignite a flammable gas.
- Cylinders must never be bled completely empty. Leave a slight pressure to keep contaminants out.
- Gases shall not be transferred from one compressed gas cylinder to another.
- When not in use, cylinders must be stored with their main valve closed and the valve safety cap in place.
- Cylinders must not be located where objects may strike or fall on them.
- Cylinders must not be stored in damp areas or near salt, corrosive chemicals, chemical vapors, heat, or direct sunlight. Cylinders stored outside must be protected from the weather.
- Corrosive gas cylinders must be returned for disposal every two years.

G. Cryogenic Liquids – Procedures for Safe Handling and Storage

The primary hazards of cryogenic liquids include both physical hazards such as fire, explosion, and pressure buildup and health hazards such as severe frostbite and asphyxiation. All laboratory personnel must follow prudent safety practices when handling and storing cryogenic liquids.

- Appropriate personal protective equipment must be worn when handling cryogenic liquids. This includes special cryogen gloves, safety goggles, full face shield, impervious apron or coat, long pants, and full coverage shoes.
- Unprotected body parts must not come in contact with vessels or pipes that contain cryogenic liquids because extremely cold material may bond firmly to the skin and tear flesh if separation is attempted.
- Objects that are in contact with cryogenic liquid must be handled with tongs or proper gloves.
- All precautions should be taken to keep liquid oxygen from organic materials; spills on oxidizable surfaces can be hazardous.
- All equipment should be kept clean, especially when working with liquid or gaseous oxygen.

- Work areas must be well ventilated.
- Transfers or pouring of cryogenic liquid must be done very slowly to minimize boiling and splashing.
- Cryogenic liquids and dry ice used as refrigerant baths must be open to the atmosphere. They must never be in a closed system where they may develop uncontrolled or dangerously high pressure.
- Liquid hydrogen must not be transferred in an air atmosphere because oxygen from the air can condense in the liquid hydrogen presenting a possible explosion risk.

Department of Physics

General Laboratory Safety Procedures:

A. Electricity

Given the inherent dangers in the laboratory study of electricity, safeguards and safety procedures need to be in place for students and teachers. Consider the following safety specifications in working with electricity:

- Know where the master switch is for electricity in the laboratory in case of an emergency.
- Make students aware of the appropriate use of electricity and dangers of misuse and abuse.
- When using batteries, always inspect them first for cracks, leaking, etc. Discard in an environmentally appropriate way if any of these conditions occur.
- When unplugging cords, always pull cords from the plug at the electrical receptacle and never pull the cords from the wire.
- Use only ground fault interrupt circuits (GFI) protected circuits!
- Remove all conductive or metallic jewelry before working with electricity.
- Prevent trip and fall hazards by placing wires away from places where people walk.
- For routine maintenance like changing bulbs, make sure the device is unplugged before initiating the work.
- Never open a battery. The contents are corrosive and can be toxic or poisonous.
- When storing batteries, never allow the terminals to touch or short circuit.
- Be water phobic when working around electricity. Never use water or have wet hands when dealing with cords, plugs or electrical equipment. Never run a cord near or over a sink.
- Utility pipes such as water and gas are grounded. Do not touch an electrical circuit and utility pipes at the same time.
- Never plug damaged electrical equipment into a wall receptacle. This includes frayed wires, missing ground pin and bent plugs.
- Never overload circuits as they will overheat and cause power outages or fires.

B. Mechanics:

The study of mechanics in physics provides many touchstones to everyday applications. However, laboratory activities in this area are not without danger. Students and teachers can be injured if hit by rapidly moving objects or projectiles.
Always use caution when dealing with falling objects, moving equipment, exposed belts, powerful permanent magnets, sharps such as Exacto knives and razor blades, and springs.

C. Ionizing Radiation:

Staff, students and others working within the Physics Building should be aware that ionising radiation is used for teaching and research purposes and they should be generally aware of the

risks associated with this particular hazard. Ionizing radiation is radiation in which an individual particle (for example, a photon, electron, or helium nucleus) carries enough energy to ionize an atom or molecule (that is, to completely remove an electron from its orbit). If the individual particles do not carry this amount of energy, it is essentially impossible for even a large flood of particles to cause ionization. These ionizations, if enough occur, can be very destructive to living tissue. The composition of ionizing radiation can vary. Electromagnetic radiation can cause ionization if the energy per photon is high enough (i.e. the wavelength is short enough). Ultraviolet light (far and extreme UV regions), X-rays, and gamma rays are all ionizing radiation, while visible light, microwaves, and radio waves are not. Ionizing radiation may also consist of fast-moving particles such as electrons, neutrons, or small atomic nuclei. There is a natural background of ionising radiation that comes from two major sources, cosmic radiation and naturally occurring radioactive isotopes such as radon, potassium, uranium and thorium. The major concern with using any radioactive nuclide is radiation exposure in air over an unshielded vial. When considering having students work with ionizing radiation, it is necessary to have planned safety protocols in place. The following safety procedures should be reviewed and adopted prior to dealing with radioactive materials:

Shielding: Lead foil is the best shield for gamma rays from any radioactive source.

Detection: A small drop of contamination containing radioactive materials can be easily detected using an end window Geiger-Mueller (GM) tube.

❖ **Safety Rules:**

If the following safety precautions are used, personnel radiation exposure will be as low as reasonably achievable.

- To prevent accidental entry of radioactive materials into the body, high standards of cleanliness and good housekeeping must be maintained in all laboratories where radioactive materials are present and/or used.
- Table and bench tops should be of a nonporous, chemical resistant material. Working surfaces shall be covered with absorbent paper regardless of the type of surface.
- Designate a specific area of the lab for handling radioactive isotopes.
- Place the shielding near a wall (not toward another work area on the other side of the bench) away from the main flow of traffic in the lab.
- Full-length lab coats must be worn by all persons who handle radioisotopes.
- Protect your hands from becoming contaminated from spills by wearing two pairs of disposable gloves.
- A detector must be in operation during the experiment, and preferably at all other times. To avoid contaminating the detector, place a thin sheet of plastic (i.e., Saran Wrap) around the detector.
- Place all vials and test tubes containing radioisotopes behind a Lead foil shield. Check the radiation level in front of the shield to determine if additional Lead foil should be added.
- Never pipette any radionuclide by mouth.
- Check your gloves frequently for contamination. If contamination is found, immediately dispose of the gloves in the radioactive waste container.
- If any contamination is found on your shoes and/or clothing, you will likely have to remove the item temporarily until the radiation decays.

- If any contamination is found on your hands, wash thoroughly with soap and water. This will usually be sufficient to remove the surface contamination. If it does not, contact the RSO (Radio Safety Officer) for assistance.
- If any contamination is found on equipment, etc., use a commercial radiation contamination remover (i.e. Count Off) with paper towels to clean up the equipment.
- If contamination cannot be removed, contact the RSO to obtain shielding materials and place a radiation label on the equipment indicating that it is I-125, maximum cpm found, and the date you measured the level.
- Inform your fellow lab workers if any unremovable contamination is found.
- Store the waste temporarily in containers which are sufficient to absorb gamma rays.
- Wash your hands thoroughly.
- Eating or drinking in laboratories that deal with radioactive materials is unsafe and forbidden. Refrigerators will not be used jointly for foods and radioactive materials.
- One or more trial runs beforehand with nonradioactive materials are recommended for new procedures and new personnel to test effectiveness of procedures and equipment.
- Do not work with radioactive materials if there is a break in the skin below the wrist.
- When work is completed each person will clean up his own work area and arrange for disposal or proper storage of all radioactive materials and equipment.
- Wash hands and arms thoroughly before handling any object that goes to the mouth, nose or eyes (e.g., cosmetics, foods). Keep fingernails short and clean.
- Laboratories shall provide special radioactive waste containers. These shall bear the words "Caution, Radioactive Waste" and a warning to janitors against handling.
- Check the normal trash container to make sure no radioactive waste has been accidentally placed there.

D. Nonionizing Radiation – Lasers:

Nonionizing radiation consists of electromagnetic radiation that lacks sufficient energy to ionize matter. These may include the use of lasers, microwaves and infrared radiation in the physics laboratory. Nonionizing radiation can cause injury if handled improperly.

The most common nonionizing radiation equipment used in physics laboratories is the laser. Safety specifications vary depending on the class of laser instrument being used. The following general safety specifications provide prudent advice and direction for use in high school physics courses:

- Before operation, warn all individuals present of the potential hazard.
- Use the laser away from areas where the uninformed and curious might be attracted by its operation.
- In conspicuous locations inside and outside the work area and on doors giving access to the area, place hazardous warning signs indicating that a laser is in operation and may be hazardous.
- Remove all watches and rings before changing or altering the experimental setup. Shiny jewelry can cause hazardous reflections.
- Practice good housekeeping in the lab to ensure that no device, tool or other reflective material is left in the path of the beam.
- Before a laser operation, prepare a detailed operating procedure outlining operation.

- Cover all exposed wiring and glass on the laser with a shield to prevent shock and contain any explosions of the laser materials. Be sure all nonenergized parts of the equipment are grounded.
- Set up the laser so that the beam path is not at normal eye level, i.e., below 3 feet (9 meters) or above 5 feet (2 meters).
- Use shields to prevent strong reflections and the direct beam from going beyond the area needed for the demonstration or experiments.
- Whenever a laser is operated outside the visible range (such as a CO_2 laser), a warning device must be installed to indicate its operation.
- A key switch to lock the high voltage supply should be installed.
- View holograms only with a diverged laser beam. Be sure the diverging lens is firmly attached to the laser.
- Illuminate the area as brightly as possible to constrict the pupils of the observers.
- The target of the beam should be a diffuse material capable of absorbing the beam and reflection
- Do not at any time look into the primary beam of a laser.
- Do not aim the laser with the eye. Direct reflection can cause eye damage.
- Do not look at reflections of the beam. These, too, can cause retinal burns.
- Do not use sunglasses to protect the eyes. If laser safety goggles are used, be certain they are designed for use with the laser being used.
- Report any afterimage to a doctor, preferably an ophthalmologist who has had experience with retinal burns. Retinal damage is possible.
- Do not leave a laser unattended.

Other Non-Ionising Radiation: Other forms of non-ionising radiation include: • Ultraviolet light • Radiofrequency radiation • Microwave ovens and radiation. All personnel working with radiation must have received appropriate training in relation to the hazard. Staff and students are required to comply with the workplace procedures and to report any accidents or incidents and also any safety, health or security concerns. Each individual is responsible for taking reasonably practicable steps to ensure their own safety and personal security when working with radiation.

E. Static Magnetic Fields:

Magnetic fields are commonly used in physics research laboratories. In most cases the fields are confined within the equipment and pose little if any risk to nearby workers. However in some specialised cases these fields extend well beyond the equipment and can pose potential hazards. These hazards include generating large forces on nearby ferromagnetic objects, damage to magnetic equipment and devices including credit cards and potential interference with various medical devices including cardiac pacemakers.

F. Nanoparticles:

The primary routes of exposure for nanoparticles are inhalation, dermal absorption, and ingestion. Nanoparticles or nanomaterial used in laboratory experiments will likely be in one of three forms: a powder, in suspension, or in a solid matrix. The form of the nanoparticles or

nanomaterial will play a large role in the exposure potential. For example, a nanoparticle in powdered form will present a larger inhalation hazard potential than a nanoparticle in suspension. Once inhaled, nanoparticles can deposit within the lung tissue, potentially causing lung function decrements and obstructive and fibrotic lung diseases, or translocate through the vascular and/or nervous system to other regions of the body, including the brain2.

Some common tasks that present some potential for exposure include:

- Working with nanoparticles in suspension without gloves;
- Working with nanoparticles in suspension during pouring or mixing where agitation is involved;
- Generating nanoparticles in the gas-phase;
- Handling nanoparticle powders;
- Maintenance on equipment used to produce nanoparticles;
- Cleaning up spills or waste material;
- Cleaning dust collection systems; and
- Machining, sanding, grinding or mechanically disturbing nanomaterial which can generate an aerosol.

Special Handling and Storage Requirements:

- Avoid contact with skin, eyes, and inhalation.
- Avoid handling nanomaterials in the open air in a "free particle" state.
- Store dispersible nanomaterials, whether suspended in liquids or in a dry particle form in closed containers whenever possible. Store in a cool, dry, and well-ventilated area.
- Clean up the work area at the end of each work shift; at minimum, using either a HEPA-filtered vacuum cleaner or wet wiping methods. Dry sweeping or air hoses should not be used to clean work areas. Cleanup should be conducted in a manner that prevents worker contact with nanomaterials.

G. The ultraviolet–visible (UV-Vis) Spectrophotometer

The UV-Vis spectroscopy utilizes light to determine the absorbance or transmission of a chemical species in either solid or aqueous state. Personal Protective Equipment

Sample Preparation Procedure: If the sample is in the solid state, the sample should be coated on to a desired, transparent substrate. A blank sample of the transparent substrate should be brought to do the experiments. If the sample is in solution, it should be premixed to the desired concentration and a blank sample of the solvent should be brought to do the experiment. Note that quartz solution cells are located above the UV-Vis. If these cells are used, they should be cleaned before and after use with the solvent that is to be used during the experiment.

Preacautions :

- Do not open sample compartment during initialization.
- Do not open sample compartment during baseline correction. Auto zero and sampling measuring mode.
- Before placing the cuvettes in the sample holder clean the outer surface of cuvettes with tissue paper.

- Do not hold the cuvettes from its transparent optical surface.
- Operate the instrument after proper initialization.

Maintenance:

- Press the keys and handle the instrument carefully.
- When instrument is not in use switch off the instrument from mains.
- Check and replace the silica gel placed inside the instrument once in week or whenever required.
- Avoid any spillage of solution nearer to the instrument or if it happened the clean the area immediately.
- Instrument should be serviced by service engineer as per AMC or as and when required.
- Calibrate the instrument as per its calibration frequency or after any major maintenance.

Cleaning:

- Clean the cuvettes after every analysis, wash the cuvettes several time with purified water and then rinse with methanol or acetone and wipe with tissue paper, dry and store in the box.
- Clean the Outer surface of instrument with isopropyl alcohol and then dry with lint free cloth.

H. Astronomical Telescope

- Nothing affects a telescope's life span more than how and where it is stored when not in use. A good storage place should be dry, dust-free, secure, and large enough to get the telescope in and out easily. Ideally, you should keep your telescope at or near the temperature outside. Doing so reduces the cooling (or warming) time required when you set up at night.
- The best place to keep a telescope is in an observatory, which offers a controlled environment and easy access to the night sky.
- Closets in unheated garages and wooden toolsheds share many of the advantages of an observatory, although you may have to vent them to the outside so air can circulate.
- Regardless of where you store your telescope, always cover the optics. Usually, this is simply a matter of putting a dust cap over the front of the tube and plugging the focuser or covering it with a small plastic bag.
- A dark, damp telescope tube is the perfect breeding ground for mold and mildew. To avoid the risk of your scope becoming a petri dish, be sure all of its parts are dry before you store it. Tilt the tube horizontally to ensure that no water puddles on the lens, mirror, or corrector plate.

Cleaning the telescope:

- Consider cleaning an optic only when stains are apparent; otherwise, leave well enough alone. Never clean a lens or mirror just for the sake of cleaning it, because every time you touch it, you run the risk of damaging it. If an interior lens or mirror surface in a sealed telescope becomes tainted by film or mildew, take or send it to a qualified professional for disassembly and cleaning.
- Use either a camel hair brush or a can of compressed air.

- Many amateur astronomers prefer to use compressed air instead of a brush because nothing touches the surface. Hold the can upright with the nozzle away from the lens at least as far as recommended by the manufacturer. If the can is too close or tilted, some of the propellant could strike the glass surface and stain it. Also, best results come with several short spurts of air instead of one long gust.
- After removing the dust, you'll want a gentle cleaning solution for fingerprints, skin oils, stains, and other residue.
- Dampen a piece of sterile surgical cotton or lens tissue with the solution. Don't use most off-the-shelf cotton balls, bathroom tissue, or facial tissue.
- Squeeze the cotton or lens tissue until it's damp, not dripping, and gently blot the lens. Never use elbow grease to get out a stubborn stain — the only pressure should be from the weight of the cotton wad or lens tissue.

Cleaning mirrors:

- When you clean a mirror, take special care not to damage the fine optical surface. The mirror's thin coating of aluminum is extremely soft, especially when compared to abrasive dirt, and you can gouge it easily.
- Cleaning a telescope's primary or secondary mirror typically requires you to remove it and the cell that holds it in place from the telescope. Consult your owner's manual for specific instructions.
- With the mirror lying on a table, use compressed air to begin the cleaning. Don't use a brush for this step, to avoid any possibility of damage.
- Next, inspect the mirror's coating for pinholes and scratches. A good coating can last 10 years or longer if the mirror has been well cared for
- Any scratches or pinholes in the coating will become immediately obvious, as well. You can live with a few, but if scratches or pinholes abound, or if you detect an uneven coating, you'll want to send the mirror out for recoating.
- If the coating is acceptable, bring the mirror to a sink. Be sure to clean the sink first and lay a folded towel in it as a cushion just in case the mirror slips. Gently run lukewarm tap water across the reflective surface. This should lift off any stubborn dirt particles that refused to dislodge themselves under the compressed air.
- Next, fill the sink with enough tepid tap water to immerse the mirror and add to it a few drops of gentle liquid dish soap. Carefully lower the mirror into the soapy water and let it sit for a minute or two.
- With a big, clean wad of surgical cotton, sweep across the mirror's surface ever so gently with the backward rolling motion I described earlier, being careful not to bear down. Roll the cotton a half-turn backward, discard it, and use a new piece. If stains remain after this step, let the mirror soak in the water for five to 10 minutes and repeat the sweeping with more new cotton.
- With the surface cleaned, drain the sink. Run tepid tap water on the mirror and its holder for a while to rinse away all soap. Then turn off the tap and pour room-temperature distilled water across the surface for a final rinse.
- Finally rest the mirror on a towel and let it dry.
- Other telescope parts also require occasional attention. For instance, some focusers tend to bind if you don't lubricate them occasionally. To prevent this from happening, use a little Teflon lubricant on the focuser's small pinion gear or roller. Loosen the screws (typically

two) that connect the plate to the side of the focuser's housing. Squirt a tiny bit of lubricant on the pinion teeth, tighten the cover plate, and wipe off any drips, as required.

- If a metal telescope mounts starts to bind, lubricate the axes' bearing points. Some manufacturers recommend this be done at specific intervals, while others make no mention of it at all. If the latter is true, then do it once a year.

Department of Earth Science

GEOGRAPHY LABORATORY

Geography laboratory consists ***GIS lab*** with 30 computers and server for GIS practical. The Lab is equipped with software in Remote Sensing, Digital Image Analysis and Geographical Information System. The various software available includes: ARC GIS 10.1. QGIS 3.4, SAGA 6.4, installed in 31 desktop. The Remote Sensing and Geographical Information System Lab were established within Department of Earth Science, USTM in 2009. The objective of establishing lab within the department was to provide exposure of this important technology to students of department. The area of Geo-informatics finds its application in variety of projects for information extraction and management. Since its inception, the lab has been catering to the students practical and research in different studies for their Post Graduate and Doctoral thesis. The lab is also equipped for providing Consultancy in the area of Remote Sensing and GIS applications through several training programmes already successfully completed in the department.

In other room (***Cartographic lab. –I***) has 10 Aerial Photographs, 05 Satellite Imagery and 30 handheld GPS receivers. This laboratory provides facilities for photogrammetry and aerial photo interpretation with instruments like 05 pocket stereoscope and 03 mirror stereoscope. Other equipments include planimeter, rotameter, barometer, thermometer, wind vane and rain gauge. There is a Map Library consisting of 30 Survey of India topographic sheets on different scales covering different areas of the country and 05 weather maps. The lab is equipped with 10 tracing table for students.

In another room (***Cartographic lab.-II***) has 10 tracing tables for students. The lab is equipped with different survey instruments for surveying like plane table (05), ranging rods (25), prismatic compass (06), Aledaide (05), staff (05), measuring tape (05), stands (10), Iron peg (08),

Dumpy level (03) and Thedolite (02).

Teachers, research scholars and post-graduate students have access to these facilities for their research and miscellaneous use. In addition, the department has modern classrooms equipped with smart boards, latest audio-visual aids and provides a comfortable ambience for research

and teaching. Around 15 Students pursuing their PhD Degree working in this lab and 01 student had completed PhD. They are working on various topics using Remote Sensing and Geographical Information System. Around 100 students have completed post graduate projects in the different areas of RS and GIS.

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

In our department special care for laboratory and equipments were taken for maintenance like:

- Cleaning of laboratory daily properly by non teaching staffs.
- Cleaning of all equipment in a week.
- We consult manual before cleaning.
- Cleaning of some instruments by qualified professionals. We calibrate our instruments to maintain accuracy of data
- We carry out an inventory of our equipment and decide which is most suitable for which practical– from basic preventative maintenance to more advanced accuracy verification.
- Regularly we calibrate equipment for ongoing preventative maintenance that will keep our lab sharp.

From time to time, lab items were wearing out and stop working. But, rather than immediately disposing of faulty equipment, we try to repair by experts. Some equipment/software we updated and maintained rather than simply disposed of. For larger items, repairing and replacing parts can be an effective way to increase lifespan and keep down costs. Due to the nature of the items, some parts will wear quicker than others but, when adequately managed; we replaced in time to prevent problems.

In case of GIS lab, from time to time we delete old data to free memory space. Costly satellite images and Open series map we downloaded from different websites free of cost and provided to the students for practical works. We downloaded Open source software from different websites and installed in the desktop.

We manage our laboratory by some rules and guidelines. First we divided students into groups to perform their practically freely in laboratory and also in the field without any hassle. Instruments, maps and any devices are issued to students totally on the basis of proper record

in the laboratory register. Proper entry register is maintained in the GIS laboratory.

Some important rules in all the laboratories are:

Entry to any laboratory is restricted in the absence of faculty.

GIS Laboratory

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

Cartographic Laboratory

Students must

1. Must sit only in their assigned work counters.
2. Students keep their bags on the rack provided.
3. Not eat in the lab.
4. Not use mobile phones / listen to music in the lab.
5. Not carry any plastic packets inside the lab.
6. Carefully handle all equipments provided by the college and return the same to the teacher after completion of the class.

7. Keep all the equipment, maps in its correct place.
8. Use tracing boards for tracing patterns.
9. Ensure that all lights in the tracing boards and lights, fans in the lab. are switched off after the class.
10. Carry a personal duster for each class
11. Keep the lab clean and should not litter the place.
12. Collect all scraps of paper and fabric leftovers in the dustbins provided.
13. Must clean their tables and work areas before leaving the lab
14. Must keep the machines and dress forms covered when not in use.
15. Should not leave behind any pins or ribbons on the dress form.
16. Ensure that all lights and fans are switched off after the class.
17. Take care of all their belongings; the college cannot be held responsible for the loss of the same.

Campus
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