# Vimala College (Autonomous)

## Thrissur


## Department of Physics

# Standard operating procedure
# For
# The Lab

**Funded by**
**DBT STAR College Scheme**
**Department of Biotechnology**
**Govt. of India**

**June 2023**

# Vimala College (Autonomous), Thrissur

## Post Graduate & Research Department of Physics

## Standard Operating Procedure of the Lab

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# Standard Operating Procedures of the Lab

## 1 Preparation of the Lab

1. Equipments and chemicals for the lab are purchased from time to time as per the requirements.
2. Request with list of major and minor equipment to be purchased for the academic year is given to the Principal by the Head of the Department (HoD).
3. After appropriate tendering/quotation the purchase committee decide the purchase of the required items and is made available in the lab.
4. The purchased items are entered in the stock register and numbered and handed over to the laboratory staff by the HoD.
5. The newly added items are labelled and maintained in the lab.
6. List of experiments to be carried out by the concerned teacher to the laboratory staff and the various apparatus for the experiments are set by the lab staff prior to each lab.
7. After completion of each lab class, the equipment is checked and placed in the appropriate places.

## 2 Execution of Lab Experiments

1. Attendance is must for all experiments. Students who miss 25% (or, as per the syllabus followed) experiments shall not be permitted to write the exam.
2. Make up labs are not promoted except under unforeseen circumstances.
3. No eating or drinking is allowed during class in laboratory.
4. The grading guidelines shall be strictly followed as per the syllabus followed for each batch.
5. Each student must submit an individual report for every lab paper.
6. Cover page must include title of every experiment, page number and date.
7. Aim, apparatus, theory and principle, relevant diagrams and procedure must be recorded along with the observations, graphs (optional) and result for every experiment.
8. Error calculations must be shown in PG experiment records.
9. The students must submit attested lab records for the exam.

## 3 Performing Experiments in Research Lab

1. Strictly follow the procedures while operating the Major equipment.
2. Step by step procedure for switching on and off the system as per the SOP to be followed.
3. Enter the details in the logbook.
4. Report to the concerned faculty member or supervising guide regarding any improper functioning of the system.
5. Do not use USB to copy data. Only CD to be used.
6. Do not tamper or remove any accessories from one instrument to other without the permission of the concerned teacher in charge.
7. Keep the working place always neat and tidy.
8. Chemical mixing or material synthesis should not be performed in the air-conditioned lab.
9. Always use Fume hood for chemical synthesis.
10. Do not waste electricity, consumables and water.
11. Do not work alone in the lab without prior permission from supervisor and HoD.

## 4 The Preventive and Corrective Measures

1. Report all accidents, injuries or breakage to the teacher in charge/ lab attendant immediately.
2. Do not perform unauthorized experiments. Get the permission of teacher in charge before you try something original.
3. Be careful when working with apparatus that may be hot. If you must pick it up, use tongs, a wet paper towel, or other appropriate holder.
4. If a thermometer breaks, inform the teacher/lab attendant immediately. Do not touch either the broken glass or the mercury with your bare skin.
5. Ask the teacher to check all electrical circuits before you turn on the power.
6. When working with electrical circuits, be sure that the current is turned off before adjusting in the circuit.
7. Do not connect the terminals of a battery or power supply to each other with a wire. Such a wire will become dangerously hot.
8. Return all equipment, clean and in good condition, to the designated location at the end of the lab to the concerned staff. Leave your lab area cleaner than you found it.
9. Avoid skin and eye contact with all chemicals. Minimize all chemical exposures. Never leave containers of chemicals open.
10. Be vigilant of warning signs when unusual hazards, hazardous materials,

hazardous equipment, or other special conditions are present.

11. Do not taste or intentionally sniff chemicals. Never consume and/or store food or beverages or apply cosmetics in areas where hazardous chemicals are used or stored.

## 5 SOP for the Safety Measures to be Followed in the Lab

1. Be always alert and attentive in the lab. Follow all written and verbal instructions. Never hesitate to ask your doubts.
2. Report all accidents, injuries or breakage to the teacher in charge/ lab attendant immediately. Also, report any equipment that you suspect is malfunctioning.
3. Avoid wearing overly bulky or loose-fitting clothing, or dangling jewelry that may become entangled in your experimental apparatus. Pin or tie black long hair.
4. Use goggles:
   a. when heating anything.
   b. when using any type of projectile or laser experiments
   c. when instructed to do so.
5. Do not perform unauthorized experiments. Get the permission of teacher in charge before you try something original.
6. Be careful when working with apparatus that may be hot. If you must pick it up, use tongs, a wet paper towel, or other appropriate holder.
7. If a thermometer breaks, inform the teacher/lab attendant immediately. Do not touch either the broken glass or the mercury with your bare skin. Ask the teacher to check all electrical circuits before you turn on the power.
8. When working with electrical circuits, be sure that the current is turned off before adjusting in the circuit.
9. Do not connect the terminals of a battery or power supply to each other with a wire. Such a wire will become dangerously hot.
10. Return all equipment, clean and in good condition, to the designated location at the end of the lab to the concerned staff. Leave your lab area cleaner than you found it.
11. Know locations of laboratory eye wash stations, fire extinguishers and emergency exit routes.
12. Avoid skin and eye contact with all chemicals. Minimize all chemical exposures. Never leave containers of chemicals open.
13. Be vigilant of warning signs when unusual hazards, hazardous materials,

hazardous equipment, or other special conditions are present.

14. Do not taste or intentionally sniff chemicals. Never consume and/or store food or beverages or apply cosmetics in areas where hazardous chemicals are used or stored.
15. Wash exposed areas of the skin prior to leaving the laboratory.
16. No cell phone or earphone usage in the active portion of the laboratories, or during experimental operations.

# Equipments

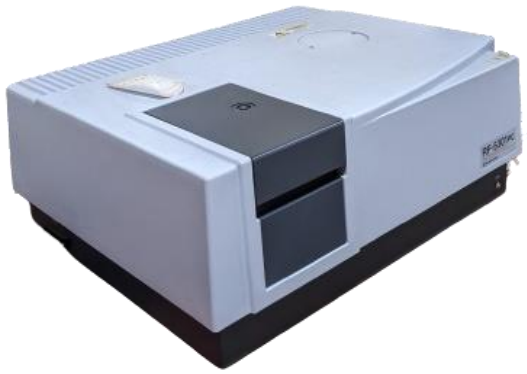
## 1 Spectro Fluro - Photometer (Shimadzu RF 5301-PC)

1. Plug on instrument and computer
2. Switch on the instrument (First white switch, wait for 10 minutes and second black switch in the right-back side of the instrument)
3. Open RFPC software in the desktop of the computer
4. Wait until the check process completes (all bubbles become green)
5. Place the sample in the sample holder (Separate holder for powder and liquid samples) and insert into the instrument properly
6. In the RFPC window, click Configure → Parameters →Set excitation and emission wavelength. Adjust slit width as necessary (If the graph goes out of scale) (Warm up – 30 minutes)
7. Start the measurement
8. After measurement, to save data,

- Click Manipulate → Data print → Edit → Copy all
- Paste in Excel sheet

### Caution:

1. During plugging, the order of switches should be strictly followed.
2. While switching off, the order of switches must be in reverse order (first black switch, wait for 10 minutes, then white switch)
3. Do not open the instrument while working.
4. Cuvette should be handled with care and should be cleaned before and after use by using distilled water. Don't touch in the transparent side
5. While using powdered samples, quartz plate used to hold the sample should be handled with care.



## 2 Spectro Photometer (Shimadzu UV 2600)

1. Plug on instrument and computer
2. Switch on the instrument (switch is on the front right of the instrument)
3. Place the Cuvette holder in the instrument
4. Open UVprobe 2.43 software in the desktop
5. Click on the connect icon and wait until the check process completes (all bubbles become green)
6. In the title bar click on m-parameters icon

- Measurement - set wavelength range - 800-200 nm, sampling interval-1
- Operation - untick Data process
- Instrument parameters - set measuring mode - absorbance, slit width - 1, detector unit - Direct

7. For baseline correction

- Take water in both cuvettes (plane glass in the case of films)
- Click baseline icon
- Set wavelength range 800 - 200 nm
- Click ok

8. After baseline correction, replace first Cuvette with sample solution
9. Start measurement
10. To save data, file - save as text file
11. Click the disconnect icon after the measurement of samples are taken.

**Caution:**

1. Do not open the instrument while working.
2. The cuvettes used should be handled with care, make sure that the cuvettes are placed such that the light passes through the transparent sides of the cuvettes.
3. The cuvette should be cleaned before and after use by using distilled water.

## 3 Diffuse Reflectance Spectrometer (DRS) with Spectro Photometer (Shimadzu UV 2600)

1. Plug on instrument and computer
2. Switch on the instrument (switch is on the front right of the instrument)
3. Place the DRS setup in the instrument
4. Open UVprobe 2.43 software in the desktop
5. Click on the connect icon and wait until the check process completes (all bubbles become green)
6. In the title bar click on m-parameters icon

- Measurement - set wavelength range - 800-200 nm, sampling interval-1
- Operation - tick Data process
- Instrument parameters - set measuring mode - Reflectance, slit width - 5, detector unit - External 1

7. For baseline correction

- Take the standard sample (Barium Sulphate) in the holder.
- Click baseline icon
- Set wavelength range 800 - 200 nm
- Click ok

8. After baseline correction, replace the holder with sample powder. The sample powder should be pressed tightly using the transparent side of the glass cylinder.
9. Start measurement
10. To save data, file - save as text file
11. Click the disconnect icon after the measurement of samples are taken.

### Caution:

1. Do not open the instrument while working.
2. Ensure that the pressed powder should not fall inside the instrument.
3. The glass cylinder and the sample holder should be cleaned thoroughly using acetone.
4. The transparent side of the glass cylinder should not touch any surface other than samples.

## 4 Hot air Oven (Rotek)

1. Plug on the instrument
2. Place the sample inside the oven
3. Switch on the control
4. Set the temperature (by clicking on the increment and decrement button)
5. Switch on the fan
6. Switch on the heater
7. After the required time switch off the heater first, then control and then fan
8. Unplug the instrument

### Caution:

1. While switching off the machine the reverse order should be followed (heater, control, and fan)
2. Don't open the door while heater is on

## 5 Vacuum Hot air Oven (Rotek)

1. Plug on the instrument
2. Place the sample inside the oven
3. Close outlet valve and open rotary valve
4. Switch on the control
5. Set the temperature (by clicking on the increment and decrement button)
6. Switch on the rotary pump, set desired vacuum then close the rotary valve, then switch off the rotary pump
7. Switch on the heater
8. After the required time switch off the heater first and then control
9. Open the outlet valve
10. Unplug the instrument

**Caution:**

1. While switching off the machine the reverse order should be followed
2. Don't open the door while heater is on

## 6 High Temperature Programmable SiC Furnace (Eurotherm)

(Temperature range: 0-1350 $^{o}$C)

1. Open the furnace door gently and place the sample inside.
2. Switch on the power supply (lever should be pulled upwards)
3. Turn the control switch to ON position (towards right)
4. Turn the auto manual switch to manual mode by pressing it.
5. Press the program button to select the program list.
6. In the program list, set the target temperature, ramp unit(hour/min), ramp time, dwell unit, dwell time, ramp down time etc. in separate segments.
7. After the program is set, select the run list using the program button and, in the run, list select the program number to be performed using the arrow buttons.
8. After the program is selected in the run list, shift the auto/manual button to auto mode.
9. Press the run button
10. Turn on the heater switch (red switch-towards right)
11. When we turn on the furnace if there is any problem in running a program, check whether any other program is already running. If so, make the status of that program as OFF from the Run List.

### Caution:

1. When starting a new program, make sure that the status of the previous program is off. The status can be checked from run list.
2. Don't open the door while heater is on or temperature above 100 $^{o}$C
3. In case of any spark in the chamber, suddenly switch off the power supply

## 7 Fourier Transform Infrared Spectrometer (FTIR) (IR Spirit)

1. The power supply of FTIR is always in ON mode.
2. Switch on the instrument by pressing the button on the instrument.
3. Switch on the computer and open the LabSolutions IR software.
4. check the testing process and wait until the initialization is complete.
5. Clean the agate mortar and pestle, pelletizing die etc. using Methanol. (do not use acetone)
6. Take some KBr from the desiccator grind it properly and make a thin pellet using the pelletizer(pressure to be applied-1.5 tons)
7. Carefully detach the pellet from the die and place it inside the instrument
8. Perform the 'background scan'
9. Mix a little sample with some KBr maintain the sample to KBr ratio is 1:100 and grind it properly in agate and a pellet.
10. Place the pellet inside the instrument and perform 'Sample scan'
11. Select the location of the result file and name it.
12. When the scan is complete, select Atmospheric correction>select smoothening>select calc> select ok
13. Click save to save the spectrum.
14. To save the result as a notepad file, select File>Export>then select the location.

### Caution:

1. Don't switch off the plug of the machine.
2. Don't open the chamber while instrument took reading.
3. Ensure that the pellet for the measurement should not break.
4. Always ensure that the indicator in silica gel in blue colour.

# 8 Vacuum Coating Unit (Indian High Vacuum Pump)

**Preparation of vacuum chamber for coating a thin film**

1. Cover chamber walls by using aluminium foil.
2. Load the raw materials for coating in a Molybdenum boat.
3. Place the substrates (glass, silicon, Kapton etc.) on the steel rods above the boat.
4. Close the chamber tightly.

**Working of Rotary Pump**

1. Switch on the Power.
2. All valves should be closed before on the mains.
3. Switch on the mains and rotary on the instrument.
4. Switch on the Pirani gauge.
5. Run the rotary pump until the Pirani gauge reading shows '0.007'.
6. Off the Pirani gauge button.
7. Open the roughing valve and switch on the Pirani gauge button.
8. Run the rotary pump until the Pirani gauge reading shows '0.007'.
9. Off the Pirani gauge button.
10. Close the roughing valve and open the backing valve.
11. Then on the Pirani gauge button.
12. Run the rotary pump until the Pirani gauge reading shows '0.007'.
13. Check the previous value by closing the backing and opening the roughing valve.
14. Again, check the value by opening the backing valve and closing the roughing valve.

**Working of diffusion pump**

1. Switch on the water system.
2. After 5 minutes switch on the diffusion button on the instrument.
3. After 'half an hour' open the high vacuum valve on the instrument.
4. After 5 minutes on the penning gauge.
5. Check whether the penning gauge reading shows $10^{-5}$ mbar pressure range.

**To coat the thin film**

1. Once required vacuum is attained, turn the knob towards Low tension (LT).
2. Turn the round knob on the equipment till the raw material starts melting.
3. After the raw material melts completely, turn the round knob back to the initial position.
4. Turn the LT knob back to the initial position.

**To Switch off the Instrument**

1. Close the high vacuum valve.
2. After 5 minutes off the diffusion button on the machine.
3. After 5 minutes, close the backing valve.
4. After a few minutes, off the rotary button on the machine.
5. After 15 minutes off the water system.

## Caution:

1. During the power failure, switch off the machine in reverse order. (High vacuum valve, diffusion button, backing valve, rotary button, mains)

## 9 Analytical Balance (Shimadzu)

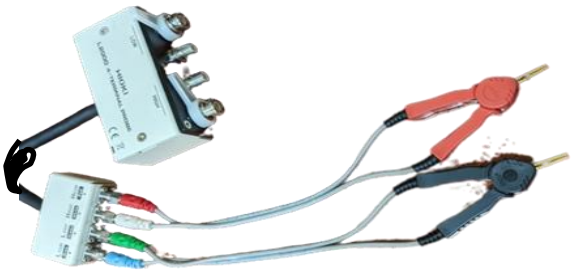
1. Use weighing paper for measuring weight less than weighing 5g
2. Fold the opposite corners of the weighing paper together and make a crease. Then do the same for the other corners
3. Place the paper on the balance pan
4. Close the side doors and press the tare button to zero out the paper
5. Use a lab scoop to slowly add the sample to the paper close the glass doors and wait for the balance to lock it is in reading
6. Continue adding sample until you reach your aim grams
7. Close the doors to read the actual weight and always document your work in your lab logbook

### Caution:

1. Always check the position of spirit leveler in the middle
2. Don't open door while taking the reading

## 10 LCR Meter (Hioki IM3536)

1. Plug on instrument and computer
2. Switch on the instrument (switch is on the front right of the instrument)
3. Connect the sample connector to the LCR meter
4. Short circuit the connector using the crocodile clip and select the short circuit calibration
5. Open the connector, set 10cm apart and select the open circuit calibration
6. Connect the sample with the connector, open software and select the desired parameter and measuring range, then click measure
7. Save the data file generated from the software
8. Switch off the instrument and computer

## 11 Dip Coating Unit

1. Plug on the instrument
2. Press button A
3. Select DIP and set DIP time (use button # moves cursor right and to left)
4. Select velocity in VD
5. Set DRY and set DRY time and velocity
6. Set travel distance DIS in mm
7. Set number of DIPS
8. Press the button A to save the program
9. Set the process number
10. Press button D for save
11. To edit the program and press button D to save
12. Press D and set the timer
13. To start the program press D
14. For setting heater and dryer temperature long press the square button and adjust by pressing the arrow up and down

## 12 Spin Coating Unit (Holmarc)

**Connections**

1. Insert the tube from the vacuum pump to the opening provided at the back panel of the spin coater.
2. Insert the mains supply cord of the vacuum pump into the socket provided at the back panel of the spin coater.
3. Connect mains supply to the spin coater through the mains cord provided and turn on the switch at the back panel.
4. Use ▲ and ▼ buttons in the front panel to shift the cursor in the display through different parameters. Select **Prog** and enter the program number. The spin coater has a five-program memory. You can create as many as five programs (Prog1 to Prog5). Prog1 is selected by default.

**Front Panel**

5. Likewise, Select Step and enter the step number as '1'. A program can contain up to five steps.
6. Enter the parameters **Speed, Accel** (acceleration/deceleration) and **Duration**. Note: If the speed entered in a particular step is less than that of its preceding step, the system will decelerate at a rate equal to what is entered in the **Accel** field.
7. Press  to save the entered values. The saved values can be retrieved whenever you select the corresponding step.
8. Select step 2 by entering 2 in the **Step** field and repeat the steps 6 & 7 to enter the parameter values. Likewise enter the values for all the five steps. Alternately, you may choose to finish with the step number of your choice by entering zero for any one parameter in the succeeding step. For example, if you want only one step, enter '0' for **Duration** in the second step. Then, the steps from 2 to 5 are avoided and the process completes after step 1.

**Placing Substrate**

9. Open the lid of the Teflon bowl.
10. Select a suitable substrate chuck and press fit it inside the Teflon bowl.
11. Place the substrate at the center of the chuck so that it completely covers the O ring on the chuck.
12. Switch on the vacuum pump by pressing the button V in the front panel and ensure the substrate is held firmly to the chuck by the vacuum force. If not, press V again to switch off the pump and check the tube connections from the vacuum pump.
13. Close the lid of the Teflon bowl.

**Coating Process**

14. After entering values and saving each step, press. The substrate chuck starts to spin and stops automatically after the specified duration (the sum of all valid steps) is over. The vacuum pump also stops after the process.
15. You can terminate the process in between by pressing.
16. Open the lid and take the substrate out

## 13 Centrifuge

1. Fill the four tubes up to 2/3$^{rd}$ of total volume
2. If solution quantity is less than the required volume, use distilled water to maintain the volume
3. Place the tube inside the holder
4. Close the door and switch on the instrument
5. Select the proper RPM and time duration
6. Switch off the instrument and open the door, then remove the tube
7. Close the door and unplug the cable from main supply

**Caution:**

1. Don't open door while instrument is working
2. Fill all tube in equal volume and use four tubes for every time


## 14 Fume Hood

1. Switch on the exhaust fan, wait for 1 minute, then open the door
2. Latch the door in decided position
3. Clean the camber using fresh cotton before use
4. Always use fume hood while handling dangerous chemical or fumy synthesis procedure
5. In case of heavy fumes, close the door completely and wait for 10 to 20 minutes

## 15 Ultrasonicator

1. Switch on the plug of the instrument.
2. Fill distilled water in the sonicator and sample container.
3. Place the samples for cleaning.
4. Press Set button for setting temperature and time.
5. Set the temperature and time using the arrow button on the machine.
6. Press cleaner and heater to start the cleaning process.
7. The cleaning process will stop after the set time.

## 16 Solar Cell Characterization Apparatus (Holmarc: HO-ED-SC-01)

1. Fix the kinematic LED mount on the optical rail
2. Place the cell mount on the optical rail
3. Insert the LED module to the mount and tighten it.
4. Insert the solar cell to the cell mount in such a way that solar cell face towards the light source (LED)
5. Connect the main power cable to the socket provided at the back panel of the apparatus. Also connect the LED module cable as shown.
6. Connect the probes of solar cell to the sockets provided on the front panel of the apparatus

**Characteristic study of solar cell without illumination**

1. Switch on the Solar cell Characterization control unit and vary the voltage from zero up to its maximum value in equal intervals
2. Note the corresponding current readings. Record these values and plot the I-V graph.
3. NOTE: Without illumination, a solar cell has the same electrical characteristics as a large diode

**Characteristic study of solar cell with illumination**

1. Turn on the LED and align the beam in such a way that the beam falls exactly on the solar cell. Use the tilting knobs of the LED mount for this
2. Bring the intensity of LED to the maximum using its rotary knob.
   Increase the voltage from zero up to its maximum value in equal intervals and record current corresponding to the voltage.
   NOTE: Since the cell is generating power, the conversion is to invert the current axis. ie., interchange the sign of current values.

## 17 Optical Fiber Characterization Apparatus (Holmarc: HO-ED-F-03)

**Study of total internal reflection & calculation of refractive index of PMMA rod**

1. Fix the kinematic laser mount on the bread board and mount the laser properly
2. Mount the PMMA rod on the optical bread board.
3. Make sure that the laser beam is exactly parallel to the PMMA rod. Rotate laser so that beam falls on the PMMA rod at an angle as shown in the figure. Fine adjustment can be done to get the angle for total internal reflection.
4. Note down incident angle of laser beam directly from the dial on laser mount. Measure the distances a and b using a meter scale.
5. Repeat the experiment by changing the angle of incidence

**Multimode Fiber Characterization**

**(i) Numerical Aperture**

1. Fix the kinematic laser mount on the optical breadboard and mount the diode laser carefully. Then fix the laser fiber coupler properly using thumb screws
2. Fix one end of the optical on the chuck and mount it on the multi axis translation stage.
3. Mount the fiber chuck holder and insert the other end of the optical fiber
4. Place XYZ translation stage and fix it on the bread board. Mount the pinhole photo detector on the stage.
5. Switch on the laser and detector. The pinhole detector should be placed very close to the fiber tip. Using the multi translation stage and lead screws provided on the kinematic laser mount couple maximum light to the fiber.
6. Make sure that the o/p from the fiber is maximum. For this move the detector in X and Y direction till the detector shows the maximum o/p current. After that adjust the diode laser using the lead screws and the laser fiber coupler till you obtain maximum current in the o/p measurement unit of the detector.

   *Note: Change the range of the O/P measurement unit to μA from mA and vice versu whenever necessary*.
7. Bring the pinhole detector very close to the tip of the fiber using the Z micro meter provided on the translation stage, i.e. almost zero distance between the lip of the fiber and the pinhole detector Note down the reading on the Z micrometre. Move the detector backwards using the 2 micrometre (say 2 or 3mm) and again note down the reading. The difference between the two readings gives the 'Z'

8. Move the detector to right or left extreme using the X micrometre. Then scan the entire beam in X direction. Each time note down the micrometre reading and o/p current from detector.
9. Plot a graph "micrometre reading versus o/p current. From the graph we can find D

**(ii) Bending loss**

1. XYZ translation stage in the above experiment (experiment to find the numerical aperture) and fix the cell mount. Mount pinhole photo detector on to cell mount
2. Place the bending loss apparatus in between the laser fiber-coupler and fiber chuck holder. For bending loss experiment we have to use a longer fiber. Fix the fiber to the bending loss apparatus. The end of the fiber connected at the laser-fiber coupler mount should not be disturbed while fixing the other end on the bending loss apparatus.
3. Wound the fiber on any of the circular diameter and connect the end to the fiber chuck holder fixed near the detector.
4. Take the output reading from the detector. Then increase the number of tums and take the corresponding readings. Repeat the experiment by changing number of tums or diameter

**(iii) Splice Loss**

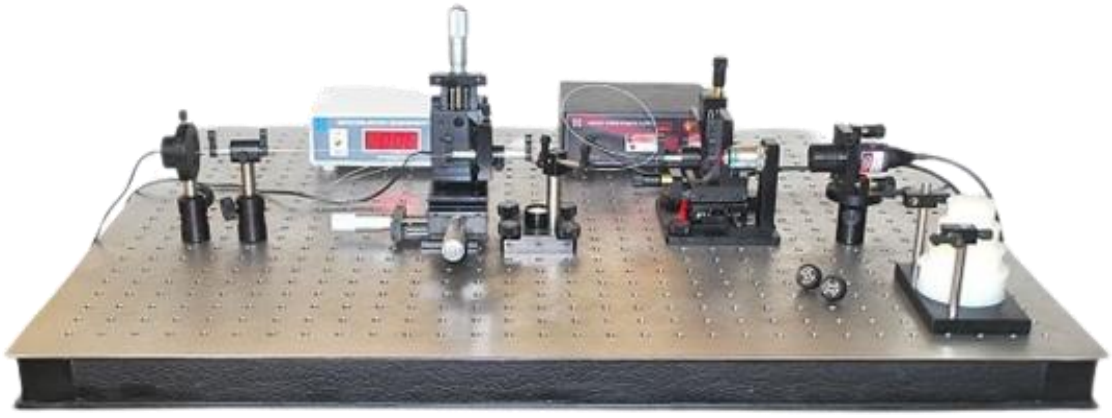
1. Mount the laser on the bread board using the laser mount and fix the laser-fibre coupler on the breadboard
2. Fix one end of the optical fibre on the fibre chuck and mount it on the multi axis translation stage of the laser-fibre coupler
3. Using thumb screws fix the rotation stage properly on the breadboard and fix the fiber on to it.
4. Take another piece of fiber and fix it on the fiber chuck
5. Insert the chuck in the cell mount of the XYZ translation stage. The fiber end fixed on the rotation stage and the receiving fiber end on the XYZ translation stage must be very close to each other.
6. Fix the fiber chuck holder on the breadboard and mount the other end of the receiving fiber.
7. Place the cell mount and insert the pinhole photo detector.
8. Switch on the diode laser and using the XYZ translation stage, laser fiber coupler and the tilt feature on the rotation stage obtain maximum output in the o/p measurement unit.
9. To study the loss due to misalignments caused in fiber, gradually move the receiving fiber end in longitudinal and transverse directions using the corresponding micrometres and note their outputs and also the micrometre readings. To study the loss due to angular misalignment, tum the rotation stage by small angles and note the corresponding readings

**Single Mode Fibre Characterization**

1. Fix the Kinematic laser mount on the optical breadboard and mount the diode laser.
2. Place the laser fiber coupler and fix it using thumb screws Mount the FC connector adapter on the laser fiber coupler carefully
3. Connect one end of the single mode fiber to the FC connector
4. Fix the cell mount on the optical breadboard and mount the FC connector adapter properly. Then connect the fiber end
5. Place the XYZ translation stage and mount the pin hole photo detector
6. Switch on the laser and O/P Measurement unit. The pinhole detector should be placed very close to the fiber tip. Using the adjusting knobs on the laser fiber coupler translation stage, lead screws provided on the kinematic laser mount and micrometres on XYZ stage couple maximum light to the fiber
7. Bring the pinhole detector very close to the tip of the fiber using the Z micrometre provided on the translation stage, i.e. almost zero distance between the tip of the fiber and the pinhole detector. Note down the reading on the Z micrometre. Move the detector backwards using the 2 micrometre (say 2 or 3mm) and note down the reading. The difference between the two readings gives the "Z".
8. Move the detector to right or left extreme using the X micrometre. Then scan the entire beam in the X direction. Each time note down the micrometre reading and the O/P current from the detector.
9. Plot a graph micrometre reading versus O/P current. From the graph we can find D

## Caution

1. Always keep the equipment in a moisture and dust free atmosphere
2. Do not touch the active region of optical components with bare hands.
3. 'Switch on' all the electronic devices used in this experiment at least once in a week



## 18 Digital IC Trainer Kit (Scientific Tech: ST DIC 1)

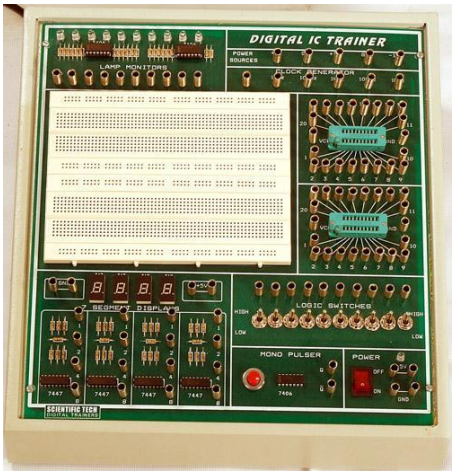
4. Keep the power ON/OFF switch in OFF position Connect power to the unit using 3-pin plug from a 3-pin socket with proper earth connection.
5. Place the IC or ICs to be tested/connected for experiments, on IC DIP sockets.
6. Connect the power to the ICs, using patch cords and complete the circuit connections by giving input. The output can be connected to logic lamp monitor or seven-segment display as per the circuit under test.
7. Switch on the power to the unit and put the power ON/OFF switch on the trainer to ON position.
8. Check the availability of power +5V/1A).
9. Clock generator output can be tapped to the required point (can be verified on oscilloscope)
10. For having monopulser output, connect from Q or Q as desired and control the push button for manual pulser action.
11. BCD output from test circuit can be given to BCD input point of seven segment LED display, for driving the display. (while testing decade counter circuit etc)
12. Example of testing an 'AND' gate and to verify the truth table is given below: -

    i. Place IC 7408 or 7409 on IC ZIF socket.

    ii. Connect pin 7 to ground and pin 14 to VCC (+5V)

    iii. Pin 1 and 2 are inputs and pin 3 is output of one of the four 'AND' gates of the above ICs. Hence connect pin 1 and 2 to the logic switch output 1 and 2 and pin 3 to any logic lamp monitor.

    iv Control the toggle switches for 00, 01, 10 and 11 input combinations and verify the output referring to the logic lamp. The lamp should glow only when both the inputs are '1' i.e. '11'. Similarly other three AND gates of the ICs can be tested. This way certain ICs can be verified on this trainer by which it is providing 'IC TESTER' facility



# 19 Cathode Ray Oscilloscope

1. Examine all the controls on your scope and set them to normal positions. For most scopes, all rotating dials should be centered, all pushbuttons should be out, and all slide switches and paddle switches should be up.
2. Turn your oscilloscope on. If it's the old-fashioned CRT kind, give it a minute or two to warm up.
3. Set the VOLTS/DIV control to 1.

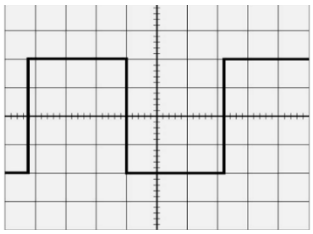
   This sets the scope to display one volt per vertical division. Depending on the signal you're displaying, you may need to increase or decrease this setting, but one volt is a good starting point.
4. Set the TIME/DIV control to 1 ms.

   This control determines the time interval represented by each horizontal division on the display. Try turning this dial to its slowest setting. Then, turn the dial one notch at a time and watch the dot speed up until it becomes a solid line.
5. Set the Trigger switch to Auto.

   The Auto position enables the oscilloscope to stabilize the trace on a common trigger point in the waveform. If the trigger mode isn't set to Auto, the waveform may drift across the screen, making it difficult to watch.
6. Connect a probe to the input connector.

   If your scope has more than one input connector, connect the probe to the one labeled A. Oscilloscope probes include a probe point, which you connect to the input signal and a separate ground lead. The ground lead usually has an alligator clip. When testing a circuit, this clip can be connected to any common ground point within the circuit. In some probes, the ground lead is detachable, so you can remove it when it isn't needed.
7. Touch the end of the probe to the scope's calibration terminal.

   This terminal provides a sample square wave that you can use to calibrate the scope's display. Some scopes have two calibration terminals, labelled 0.2 V and 2 V. If your scope has two terminals, touch the probe to the 2 V terminal. For calibrating, it's best to use an alligator clip test probe. If your test probe has a pointy tip instead of an alligator clip, you can usually push the tip through the little hole in the end of the calibration terminal to hold the probe in place. It isn't necessary to connect the ground lead of your test probe for calibration.
8. If necessary, adjust the TIME/DIV and VOLTS/DIV controls until the square wave fits nicely within the display.



9. If necessary, adjust the Y-POS control to centre the trace vertically.
10. If necessary, adjust the X-POS control to centre the trace horizontally.
11. If necessary, adjust the Intensity and Focus settings to get a clear trace.

# Annexure I

**Procedure for Conduct of Practical Exams**

**1.0 Planning**

1. The teacher-in-charge notifies the lab admin about the subject, time and date of the exams.
2. Necessary stationary items for the exam is procured from the Controller of examination for the smooth conduct of exams after placing a request.
3. The systems and apparatus to be used for the exam are identified, checked and maintained.

**2.0 Conduct**

1. The lab is cleaned and kept ready for the exam.
2. The batch wise list of students is handed over to the external on the day of examination.
3. As per the instructions of external examiner the lab exam is conducted.
4. The records of the students are collected and punctured to notify that the record is valued.
5. The internal examiner and teacher in charge will be present throughout the exams to fix problems that may arise during the conduct of examination.
6. The exam papers are evaluated by the external and the mark lists are prepared by the internal examiner.
7. The prepared mark lists are verified and signed by both examiners.
8. The answer sheets, mark lists, attendance sheets are submitted to the Controller of examinations office.
9. The unused items are also returned to the exam office

**Procedure for Project Evaluation**

**1.0 Planning**

1. Both UG and PG projects are planned by the project supervisors concerned and the students.
2. The project guide and the students take all initiatives to carry out the project work.

**2.0 Conduct**

1. Project viva and presentation will be carried out along with the external practical examination as per the regulation.

After the conduct of project viva, the software is removed, the internet connectivity and flash drives are blocked, and the systems are added back to the network.

# Annexure II

**Instructions to Laboratory Staff**

1. Laboratory employees should have access to a chemical inventory list and relevant SOPs.
2. Access to laboratories and support areas such as stockrooms, specialized laboratories, etc. should be limited to approved personnel only.
3. All equipment should be regularly inspected for wear or deterioration.
4. All containers must have appropriate labels. Unlabeled chemicals should never be used.
5. Equipment should be maintained according to the manufacturer's requirements and records of certification, maintenance, or repairs should be maintained for the life of the equipment.
6. Designated and well-marked waste storage locations are necessary.
7. Do not pour chemicals down drains. Do NOT utilize the sewer for chemical waste disposal.
8. Perform work with hazardous chemicals in a properly working fume hood to reduce potential exposures.