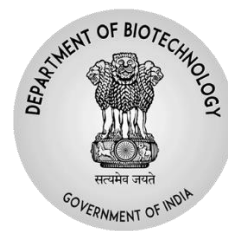




G.T.N Arts College
(Autonomous)
Department of Physics



Standard Operating Procedure

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Digital Weighing Balance



- ❖ Digital precision balance is used to measure the mass of the substance in milligram level with high accuracy.
- ❖ Before performing weighing, make sure the balance is kept clean and dry.
- ❖ And ensure that the spirit level is in the center of the circle.
- ❖ Switch on the main power supply of the balance.
- ❖ Balance should show 0.000 and if the balance is showing some reading on the display then press tare key.
- ❖ After stabilizing the balance, open the door from one side and place the container.
- ❖ Close the door and press tare key.
- ❖ Then open the door and place the material to be weighed on the pan.
- ❖ Close the door and wait until the number is fixed on the screen and note it down.
- ❖ After getting a stable display, open the door and take out the sample with container or sampling bag.
- ❖ Close the door and press 'Tare key' again.

Magnetic Stirrer with Hot Plate



- ❖ A magnetic stirrer is a device widely used in laboratories and consists of a rotating magnet or a stationary electromagnet that creates a rotating magnetic field.
- ❖ This device is used to make a stir bar, immerse in a liquid, quickly spin, or stirring or mixing a solution.
- ❖ A magnetic stirring system generally includes a coupled heating system for heating the liquid.
- ❖ Magnetic stirrer/hotplate should be used on level surfaces.
- ❖ If hazardous vapours will not be produced, hot plates should be in an area free of drafts to ensure heating efficiency.
- ❖ Keep the top surface of the magnetic stirrer / hot plate clean. Use a non-abrasive cleaner to clean the surface and the outside of the unit.
- ❖ Replace the top surface if damaged.
- ❖ Do not use metal foil on hotplates.
- ❖ Ensure that the working bench is clean.
- ❖ Ensure that the stirrer 'Speed control knob' is in off position.
- ❖ Switch on the power supply.
- ❖ Place the solution to be stirred on the magnetic stirrer.
- ❖ Increase the stirring speed by rotating the 'Speed control knob' clockwise.
- ❖ After the stirring is completed, decrease the stirring speed slowly by rotating the 'Speed control knob' anti clock wise and keep the knob in 'off' position.
- ❖ Then switch off the power supply.



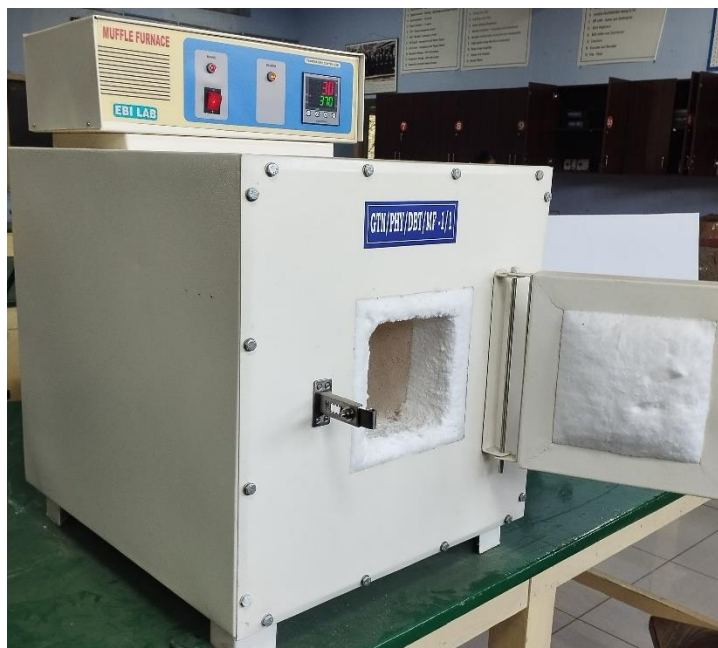
Hot Plate Operation

- ❖ Magnetic stirrers include a hot plate for heating the liquid.
- ❖ During initial operation of a hot plate, some odour and vapours may be produced from the heating element, which is normal.
- ❖ Place the sample vessel on the hotplate so that it is centred, where practical. For hot plates with multiple heating elements, centre the vessel over a heating element, where practical.
- ❖ Turn the instrument on and set the thermostat to the desired setting.
- ❖ Allow around 10 minutes for hot plate and liquid temperatures to stabilize.
- ❖ If necessary, adjust the temperature by adjusting the thermostat.
- ❖ When heating is complete, turn the unit off.

Precautions:

- ❖ Keep the top plate clean.
- ❖ Avoid spillage of sample

Muffle Furnace



- ❖ Muffle furnaces are used to achieve greater control of temperature uniformity and isolate heated materials from combustion contaminants. Excavating samples, heat-treating applications, and materials research.
- ❖ Keep the Muffle Furnace on a levelled and firm platform.
- ❖ Ensure that the instrument is connected with the main power supply.
- ❖ Both the ON/OFF power switch and digital display illuminate.
- ❖ The door safety switch removes power from the heating elements when the door is open.
- ❖ The set point controller that provides single display to indicate the current chamber temperature or set point temperature.
- ❖ When the controller is turned ON it will perform a short self-test and then display a current temperature inside the chamber.
- ❖ Then set the required temperature by pressing (▲) or (▼) arrow key until the desired set point value is displayed and then release the button.
 - ✓ Down Button: allow you to decrease a value
 - ✓ UP Button: allow you to increase a value
- ❖ A few seconds after the button is released the controller will accept the new value and raise its temperature gradually.
- ❖ The working temperature range is 100 to 1000°C.

Dielectric Constant Apparatus



Dielectric Constant Apparatus is used to measure dielectric constant of different solids such as Bakelite, Teflon etc and liquids such as distilled water, transformer oil etc.

Standard Operating Procedure:

- ❖ Connect the variable capacitor with the terminals marked variable capacitor on the front panel of the instrument.
- ❖ Switch on the instrument. Set the standard variable capacitor at 100 pF (approximately).
- ❖ Set the sensitivity of the meter at 85 μ A (approx.) by the sensitivity control knob.
- ❖ Adjust the standard capacitor knob for maximum deflection. At any position of standard variable capacitor, the deflection should be near to 85 to 90 μ A.
- ❖ Note this value of the variable capacitor as C_1 .
- ❖ Do not disturb the sensitivity knob for the whole experiment, after getting the value of C_1
- ❖ Include the unknown test capacitor and repeat the experiment by varying variable capacitor to obtain resonance point (maximum deflection) in the meter. Note this value of the variable capacitor as C_2 .
- ❖ Remove the dielectric material (Bakelite sheets) from the test capacitor and repeat the experiment by varying variable capacitor to again obtain resonance point (maximum deflection) in the meter. Note this value of the variable capacitor as C_3 .
- ❖ Repeat the experiment with materials of different thickness.

Digital pH Meter



A digital potential of hydrogen (pH) meter is an electronic gadget used to measure accurately measure and record the pH value of liquids. Measuring pH allows one to determine the acidity or alkalinity of a substance in a liquid state. The following steps are required for the calibration:

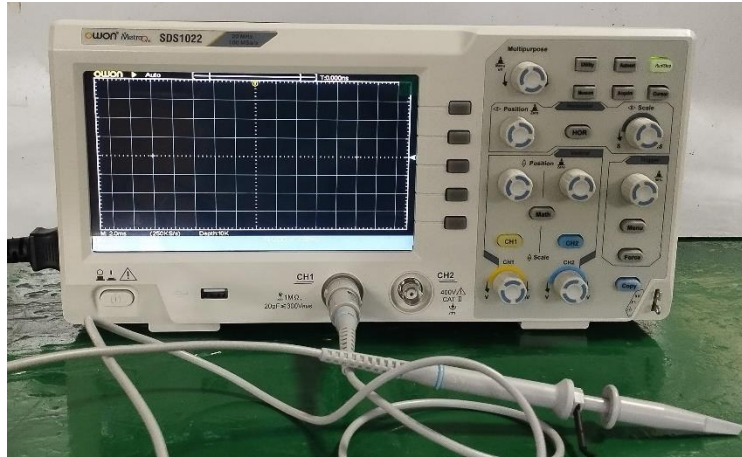
- ❖ After attaching the pH electrode to the BNC socket, wash the pH electrode with distilled water. Put the electrode in first buffer solution, say 7 pH buffer, together with temperature probe if ATC is desired. The display shows the pH value of the solution.
- ❖ Press 'Cal 7 pH' key. The display starts blinking. The blinking indicates that the system is in calibration mode. Let the pH reading stabilize (Note that the display shall still be blinking indicating calibration mode, but the variation in pH readings should stabilize).
- ❖ Press 'Cal 7 pH' key again to complete 7 pH calibration.
- ❖ Remove electrode from 7 pH buffer, wash with distilled water and put it in 4/9.2 pH' buffer, say in 4 pH buffers.
- ❖ Now press 'Cal 4/9.2 pH' key The display again starts blinking. Let the reading stabilize. Press 'Cal 4/9.2 pH' key again. The instrument is now calibrated for 4 pH.
- ❖ If 3-point calibration is desired, take out the electrode, wash with distilled water and put it in
 - 9.2 pH buffer.
- ❖ Now press 'Cal 4/9.2 pH' key. The display again starts blinking, let the reading stabilize. Again press 'Cal 4/9.2 pH' key to complete the calibration process.
- ❖ The instrument is now ready to take any pH measurements.

Spectrometer



- ❖ Spectrometer is a device for measuring wavelengths of light over a wide range of the electromagnetic spectrum. It is widely used for spectroscopic analysis of sample materials.
- ❖ The incident light from the light source can be transmitted, absorbed or reflected through the sample.
- ❖ Turn the telescope towards the white wall or screen and looking through eye-piece, adjust its position till the cross wires are clearly seen.
- ❖ Turn the telescope towards window, focus the telescope to a long distant object.
- ❖ Place the telescope parallel to collimator.
- ❖ Place the collimator directed towards sodium vapor lamp. Switch on the lamp.
- ❖ Focus collimator slit using collimator focusing adjustment.
- ❖ Adjust the collimator slit width.
- ❖ Place prism table, note that the surface of the table is just below the level of telescope and collimator.
- ❖ Place spirit level on prism table. Adjust the base levelling screw till the bubble come at the centre of spirit level.
- ❖ Clamp the prism holder.
- ❖ Clamp the prism in which the sharp edge is facing towards the collimator, and base of the prism is at the clamp

Cathode Ray Oscilloscope (CRO)



- ❖ The CRO is used to measure the voltage, current, frequency, inductance, admittance, resistance, and power factor.
- ❖ Check the AM and FM circuits characteristics
- ❖ Monitor the signal properties as well as characteristics and also controls the analog signals.
- ❖ Proper grounding is an important step when setting up to take measurements or work on a circuit.
- ❖ Proper grounding of the oscilloscope protects you from a hazardous shock and grounding yourself protects your circuits from damage.
- ❖ To ground the oscilloscope means to connect it to an electrically neutral reference point, such as earth ground.
- ❖ Ground your oscilloscope by plugging its three-pronged power cord into an outlet grounded to earth ground.

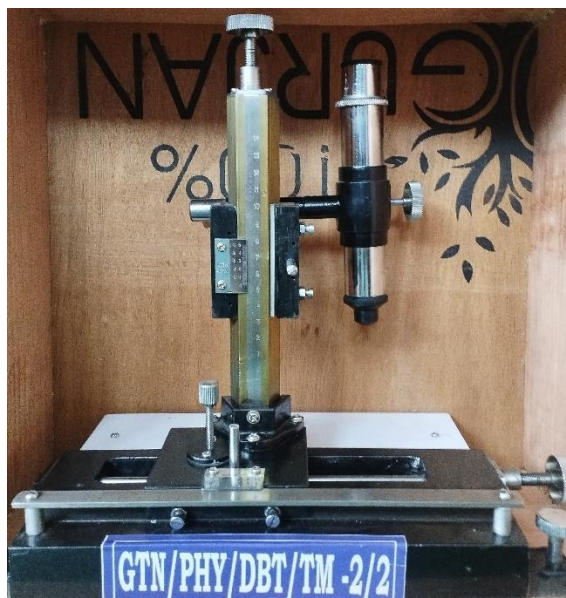
Setting the Controls

- ❖ After plugging in the oscilloscope, take a look at the front panel.
- ❖ Most oscilloscopes have at least two input channels and each channel can display a waveform on the screen.
- ❖ Some oscilloscopes have AUTOSET and/or DEFAULT buttons that can set up the controls in one step to accommodate a signal.
- ❖ Set the oscilloscope to display channel 1.
- ❖ Set the vertical volts/division scale and position controls to mid-range positions turn off. The variable volts/division turn off all magnification setting.
- ❖ Set the channel 1 input coupling to DC set the trigger mode to auto.
- ❖ Set the trigger source to channel 1 Turn trigger hold off to minimum or off.



- ❖ Set the horizontal time/division and position controls to mid-range positions.
- ❖ Adjust channel1volts/division such that the signal occupies as much of the 10 vertical divisions as possible without clipping or signal distortion.
- ❖ Most oscilloscopes have a square wave reference signal available at a terminal on the front panel used to compensate the probe. General instructions to compensate the probe areas follows:
 - ❖ Attach the probe to a vertical channel.
 - ❖ Connect the probe tip to the probe compensation, i.e.square wave reference signal.
 - ❖ Attach the ground clip of the probe to ground. View the square wave reference signal.
 - ❖ Make the proper adjustments on the probe so that the corners of the square wave are square.

Travelling Microscope



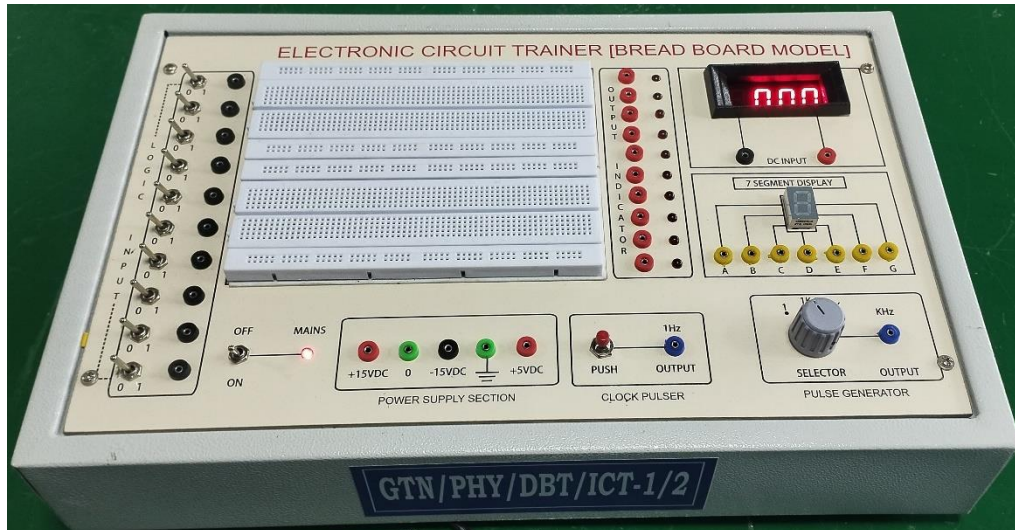
- ❖ A travelling microscope is used for the accurate measurement of diameters of different objects.
- ❖ It is also used in Physics Laboratories for more accurate determination of small variation in the liquid levels, Manometers, the refractive index of liquids as well as in surface tension & viscosity experiments.
- ❖ A microscope attached to a graduated vertical pillar, which is mounted on rigid platform.
- ❖ The platform is provided with three levelling screws. The microscope can be moved in the vertical or horizontal direction by means of a screw arrangement attached to it.
- ❖ To get a sufficient amount of light, place the travelling microscope (M) near the window.
- ❖ For clear visibility of the cross wire, adjust the position of the eyepiece.
- ❖ Place the object horizontally on the adjustable stand.
- ❖ Make the cross- wire touch one end of the object (A). Note microscope reading on the vertical scale.
- ❖ Raise the microscope to make the cross wire touch the other end of the object (B). Note the vertical scale reading.
- ❖ The difference between the two readings will give the diameter (AB) of the object.

Function Generator



- ❖ A function generator is an electronic test instrument used to generate and deliver standard waveforms, typically sine and square waves, to a device under test.
- ❖ Display Screen: Here the frequency input is shown.
- ❖ Coarse and Fine knobs: These knobs are used to set different input frequencies. The coarse knob is used to vary the frequency with a large difference, while the fine knob is used to vary the frequency in decimals.
- ❖ Frequency Range Buttons: These are used to change the range of frequency after its control; we change the frequency with the help of coarse and fine knobs.
- ❖ Duty Cycle knob: It changes the duty cycle of the wave.
- ❖ INV button: It inverts the signal.
- ❖ Function buttons: To change the type of waveform.
- ❖ ATTN buttons: This control is used to set the voltage level.
- ❖ Sync terminal: This connector sends TTL trigger signals.
- ❖ Power on the generator and select the desired output signal: square wave, sine wave, or triangle wave.
- ❖ Connect the output leads to an oscilloscope to visualize the output signal and set its parameters using the amplitude and frequency controls.
- ❖ Attach the output leads of the function generator to the input of the circuit you wish to test.
- ❖ Attach the output of your circuit to a meter or oscilloscope to visualize the resulting change in signal.

Logic IC Trainer



- ❖ Digital IC trainer kit is used to study the operation of digital Logic ICs TTL, CMOS, AND, OR, NOT, NAND, NOR, XOR Gates, Flip-Flops, Counters, Shift Register, Multiplexer and De-Multiplexer, Encoder, Decoder and ALU.
- ❖ Keep the digital logic IC trainer kit in a clean environment. This will help to prevent possible contamination.
- ❖ Check the input voltage at the power cord of the kit.
- ❖ Switch ON the kit and measure all the output voltage levels as per the specification of the kit.
- ❖ Place corresponding ICs in the breadboard one by one as per the logic circuit diagram.
- ❖ Connect the output voltage V_{cc} and Ground to all the ICs
- ❖ Connecting wires should be rubbed with sand papers so that there is no rust.
- ❖ Make sure that the apparatus is switched off while placing ICs and connecting of wires
- ❖ The connections should be tight.
- ❖ ICs are placed in a proper way in the breadboard. There is no short of current in the same inputs

