

**Title of course** = Certificate Course in Lab Technology & Lab Management

**Duration** 6 Months

**Fees** Rs.6000/-

**ELIGIBILITY:** 10+2 with science subjects

**About Course:** This skill-intensive programme is designed to prepare individuals for the role of **Laboratory Technician in School and College Science laboratories**. Through a blend of theoretical instruction and hands-on practical training, learners will gain the expertise needed to support science educators and students with confidence and precision.

Whether you're starting your career or seeking to enhance your technical capabilities, this programme offers a strong foundation in laboratory operations, safety, and equipment management.

**Features:-**

- **Understand Laboratory Infrastructure** Learn about the essential facilities, tools, and equipment used in academic science labs.
- **Develop Organizational Skills** Gain the ability to efficiently manage laboratory spaces, inventory, and workflows.
- **Master Instrument Maintenance** Acquire practical skills to maintain and troubleshoot basic scientific instruments.
- **Ensure Laboratory Safety** Learn and apply safety protocols to create a secure and compliant lab environment.

**Why Choose This Programme?**

- Intensive **hands-on training**
- Focus on **real-world lab scenarios**
- Ideal for aspiring lab technicians in **educational institutions**
- Builds **confidence and competence** in lab support roles

**Module:-**

1. **Chemistry Lab Maintenance and handling**
2. **Laboratory Techniques-in Biological Sciences**
3. **Physics Lab Training**

## **Module 1. Course Curriculum on Chemistry Lab Maintenance and handling**

### **1) Safe and Systematic Laboratory Practices**

#### **1.1 Lab Safety Fundamentals (1 Hour)**

Lab safety rules and regulations.

Personal protective equipments (Lab coat, Safety glasses, Gloves, shoes covering the whole feet, Face shield etc.).

Emergency procedures and First aid basics.

#### **1.2 Hazard notification and Documentation (2 Hour)**

Understanding MSDS (Material Safety Data Sheet) of a given set of chemicals.

Common Safety Symbols along with their description.

Understanding of National Fire Protection Association (NFPA) Hazard Labels.

#### **1.3 Lab Layout and Organization (1 Hour)**

Division of lab into specific areas like General working zone, Washing and solution preparation zone, Fume-hood zone, Hazardous chemicals zone, Chemicals storage zone, Waste handling zone, Instrumentation and analytical zone.

Chemical store room layout and its management.

#### **1.4 Practical sessions and Demonstration (2 Hour)**

Eye wash and safety shower in case of chemical accident.

First aid treatment for acid, base spill, corrosive chemicals and burns.

Understanding the category and working of fire extinguisher.

Mock emergency drill.

### **2) Handling of Chemicals and Reagents**

#### **2.1 Chemical handling and storage (1 Hour)**

Classification and understanding of AR/ GR grade chemicals.

Understanding Chemical Abstract Service (CAS) Registry Number.

Handling and storage of temperature and moisture sensitive chemicals.

#### **2.2 Preparation of various solutions and Chemical Laboratory Reagents (4 Hour)**

Calculation of various types of concentrations (Normality, Molarity, % w/v etc.)

Preparation of standard solutions of different concentrations.

Primary and secondary standards.

Preparation of various indicator solutions (Phenolphthalein, methyl orange Eriochrome black T etc.)

Preparation of various reagents (Tollen's reagent, Fehling Reagent, Chromic acid, H<sub>2</sub>S gas etc.).

### 3) **Equipment uses and Maintenance**

#### 3.1 Common lab equipments: Handling and maintenance (2 Hour)

Weighing balances, melting point and boiling point apparatus, centrifuge machines, magnetic stirrers, mechanical shaker, pH meters, conductometer, Potentiometer, spectrophotometer, hot plates, hot air ovens, microwave ovens etc.

#### 3.2 Calibration of common glasswares and equipments (2 Hour)

Calibration of Volumetric flask, pipette and burette

Calibration of thermometer

Calibration of weighing balance

Calibration of pH meter

#### 3.3 Common glassware: Cleaning and handling (1 Hour)

Cleaning and drying methods for various glass wares (Separating funnel, burette, pipette, viscometer, condenser, round-bottomed flask etc.)

#### 3.4 Filtration and Purification techniques: Principle and Working (2 Hour)

Simple gravity filtration and filtration under suction

Making of fluted filter paper

Set up of distillation and reflux assemblies

Working of water and oil vacuum pump and their applications

### 4) **Waste Management (2 Hour)**

Disposal of Hazardous chemicals through standard protocols.

Waste segregation and labelling

Recycling of chemicals and solvents

## **Module 2. Basic Laboratory Techniques-in Biological Sciences**

### **1) Laboratory Orientation & Safety (1hr)**

- 1.1 Lab safety rules and symbols.
- 1.2 Safe handling of glassware, chemicals, and biological samples.
- 1.3 Waste disposal (biological, chemical).

### **2) Microscopy & Observation Skills (3 hrs)**

- 2.1 Parts, functions and principle of a compound microscope.
- 2.2 Care, handling, and focusing techniques.
- 2.3 Preparation of temporary mounts (plant cells, animal cells).
- 2.4 Staining techniques (methylene blue, safranin, Trypan blue).

Practical Activities:

- \* Observation of onion epidermal cells.
- \* Observation of cheek epithelial cells.
- \* Study of Mitosis using onion roots

### **3) Basic Cytology (3 hrs)**

- 3.1 Introduction to cell organelles through stained slides.
- 3.2 Study of plant and animal cells.
- 3.3 TLC (Total Leucocyte Count) and DLC (Differential Cell Count)
- 3.4 Counting of WBC/RBC using haemocytometer

### **4) Qualitative Biochemical tests (4 hrs)**

- 4.1 Qualitative tests for biomolecules.
- 4.2 Separation techniques
- 4.2 Understanding reagent preparation and storage.

Practical Activities:

- \* Reducing and Non Reducing Sugars, Tests for Mono, Di and Polysaccharides
- \* Biochemical tests for DNA, RNA and Proteins
- \* Basic Enzyme Activity for salivary amylase
- \* Separation of sugars/amino acids by paper chromatography

- \* Preparation of Buffers and Normal, Molar, Percent solutions and serial dilution

## **5) Microbiology Techniques (3 hrs)**

5.1 Sterilization techniques and aseptic handling.

5.2 Observation of microorganisms.

Practical Activities:

- \* Different sterilization methods
- \* Preparation of media for microbial growth
- \* Culturing, staining and observation of bacteria/yeast under microscope

## **6) Data Recording & Reporting (2 hrs)**

6.1 Planning an experiment

6.2 Interpretation of Results

6.3 Troubleshooting of scientific data

Practical Activities:

- \* Maintaining a lab record
- \* Observation and Results recording
- \* Small Project and record

### Module 3. Physics Lab Training Curriculum

#### **Every student must perform the following experiments:**

Determination of Least count and use of instruments like Vernier callipers, screw gauge and travelling microscope for measuring lengths.

Determination of Acceleration due to gravity (g) using Simple Pendulum.

Understand the applications of CRO/DSO by measuring voltage, frequency and time period of a periodic waveform using CRO/DSO.

Verification of Ohm's Law.

Resistance & Circuits: (a) Measurement of the resistivity of a wire (b) Study of series and parallel combinations of resistances.

Study of Dispersion of Light using Prism and Spectrometer.

To determine the wavelength of laser source using diffraction of single slit.

To determine the Plank's constant using LEDs of different colours.

To study the V-I Characteristics of a forward and reverse biased p-n junction diode.

To study the variation of Thermo-emf of Thermocouple with difference of temperature of its two junctions.

#### **Training Curriculum Structure & Experiments description**

##### **1. Lab Orientation & Safety: (2hr)**

1.1 **Safety Briefing:** Electrical hazards, optical safety, chemical precautions. Lab Tour: Layout, equipment identification. Theory: Errors of Observation, Accuracy and Precision, Significant figures, Least count, Plotting a Graph.

1.2 **Basic Handling:** Vernier callipers, screw gauge, Travelling Microscope, Spectrometer.

##### **2. Determination of Least count and use of instruments like Vernier callipers, screw gauge and travelling microscope for measuring lengths.**

2.1 Description of zero error and zero correction, least count and principles of instruments used.

**Experiment:** Measure lengths using Vernier callipers, screw gauge, and travelling microscope.

**Skill focus:** Accurate recording with correct units and minimal errors.

### 3. Determination of Acceleration Due to Gravity Using Simple Pendulum

3.1 Acceleration due to gravity ( $g$ ), Simple pendulum and compound pendulum.

**Experiment:** Determine  $g$  using a simple pendulum. Measure time period, plot  $T^2$  vs  $L$  graph, find  $g$  from slope, discuss sources of error.

**Skill Focus:** Graph plotting, slope interpretation, time measurement with stop clock.

### 4. Applications of CRO/DSO

4.1 Theory to Learn: Block Diagram and Principle of CRO/DSO

4.2 Experiment: Observe periodic signals; measure amplitude, frequency, and time period.

4.3 Skill Focus: Instrument handling, waveform analysis.

### 5. Verification of Ohm's Law

□ 5.1 Relationship between voltage and current, concept of linear  $V$ – $I$  characteristics.

**Experiment:** Measure current for varying voltages; plot  $V$ – $I$  graph; determine resistance.

**Skill Focus:** Electrical circuit assembly, linear data analysis.

### 6. Resistance & Circuits

□ 6.1 Resistivity formula; laws of series and parallel combinations of resistors.

**Experiment: (a)** Find resistivity of wire from measured resistance and dimensions.

**(b)** Study series and parallel resistor arrangements.

**Skill Focus:** Circuit design, precision measurement, formula application.

### 7. Study of Dispersion of Light Using Prism and Spectrometer

7.1 Refraction and dispersion of light.

**Experiment:** Use spectrometer to observe separation of colours through prism.

**Skill Focus:** Optical alignment and interpretation of dispersion patterns.

### 8. Wavelength of Laser Light Using Single-Slit Diffraction

8.1 Diffraction principle; relation between slit width, fringe width, and wavelength.

**Experiment:** Record diffraction pattern; calculate wavelength from fringe spacing.

**Skill Focus:** Optical setup handling, microscopic measurement.

### 9. Determination of Planck's Constant Using LEDs

9.1 Energy– frequency relation; LED threshold voltage and photon energy.

**Experiment:** Measure voltage for LEDs of different colours; plot  $V$ – $I$  and  $V$ – $1/\lambda$  graphs and find Planck's constant.

**Skill Focus:** Data correlation, slope interpretation.

### 10. $V$ – $I$ Characteristics of a $p$ – $n$ Junction Diode

10.1 Semiconductor diode behaviour in forward and reverse bias.

**Experiment:** Measure current for varying voltages in both forward and reverse bias conditions; plot V-I graphs.

**Skill Focus:** Semiconductor testing, non-linear curve plotting.

## **11. Thermo-emf of a Thermocouple**

11.1 Seebeck effect; relation between temperature difference and emf.

**Experiment:** Measure thermo-emf for varying junction temperature differences; plot graph.

**Skill Focus:** Temperature control, sensitive voltage measurement.

## **12. Final Project, Assessment, and Presentation**

12.1 Students independently design and perform an experiment, record and analyse data, apply error analysis, draw conclusions, prepare a lab report, and present findings to peers.

**Skill Focus:**

Experiment design, data analysis, error evaluation, reporting, and presentation skills.