



# ASCI

Agriculture Skill Council of India

# Participant Handbook

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**Agriculture and Allied**

Sub-Sector  
**Agriculture Industries**

Occupation  
**Research & Development**

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**NSQF Level 5**



**Soil and Water  
Testing Lab Analyst**

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**Shri Narendra Modi**  
Prime Minister of India

“ **Skilling is building a better India.  
If we have to move India towards  
development then Skill Development  
should be our mission.** ”



## Certificate

### COMPLIANCE TO QUALIFICATION PACK - NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

**AGRICULTURE SKILL COUNCIL OF INDIA**

for

### SKILLING CONTENT: PARTICIPANT HANDBOOK

Complying to National Occupational Standards of  
Job Role/Qualification Pack: **'Soil & Water Testing Lab Analyst'** QP No. **'AGR/Q8103 NSQF Level 5'**

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\*Valid up to the next review date of the Qualification Pack or the  
\*Valid up to date Mentioned above (whichever is earlier)

Authorised Signatory  
(Agriculture Skill Council of India)

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We are thankful to all organisations and individuals who have helped us in preparation of this Participant Handbook. We also wish to extend our gratitude to all those who reviewed the content and provided valuable inputs for improving the quality, coherence and content presentation of chapters. This handbook will lead to successful roll out the skill development initiatives, helping greatly our stakeholders particularly trainees, trainers and assessors etc.

It is expected that this publication would meet the complete requirements of QP/NOS based training delivery, we welcome the suggestions from users, Industry experts and other stakeholders for any improvement in future.

## About this Book

This Participant Handbook is intended to enable the participant to prepare himself/herself for serving as Soil & Water Testing Lab Analyst as per the Qualification Pack (QP).

Qualification Pack is combination or set of different National Occupational Standards (NOS) essential to qualify for the certification of the Job Role. Every National Occupational Standards (NOS) is spread over Unit/s. Key Learning Outcomes for the NOS check the start of the Unit/s for that NOS. The images used as a part of this book are portrayed beneath. Soil & Water Testing Lab Analyst is in charge of Installation, and Testing for better management of the soil and water health, leading to increment in yield of produce. NOS guide an individual to acquire knowledge during this programme and help him/her to accomplish a task after this programme. These word-related guidelines are appropriate both in the Indian and worldwide settings. This handbook would enable the participant to implement the learnings by enriching himself/herself in following critical pillars of success:

- **Knowledge and Understanding:** Satisfactory operational learning and comprehension to play out the required chore.
- **Performance Criteria:** Pick up the required aptitudes through hands on preparing and play out the required operations inside the predetermined measures.
- **Professional Skills:** Capacity to settle on operational choices relating to the zone of work.

The system additionally incorporates field visits for the participants where they can watch the method/operations of the soil and water testing. Chapters are prepared to build up the expert abilities like – choices making, systematic and basic considering. We hope the participants will be able to acquire knowledge with the help of facilitator to make this programme a success to the recommended standards.

## Symbols Used



Key Learning Outcomes



Steps



Example



Tips



Notes



Unit Objectives



Exercise



Activity

## Table of Contents

S.No.	Modules and Units	Page No.
<b>1.</b>	<b>Introduction</b>	<b>1</b>
	Unit 1.1 – About the Training Programme	3
	Unit 1.2 – Types of Soil and Nutrients	4
	Unit 1.3 – Soil-Water Test and Integrated Nutrient Management	6
	Unit 1.4 – About the Job role - Soil and Water Testing Lab Analyst	7
<b>2</b>	<b>Sanitation and Safety Guidelines of the Lab (AGR/N8101)</b>	<b>11</b>
	Unit 2.1 – Lab Layout and Apparatus	13
	Unit 2.2 – Personal Hygiene and Lab Sanitation	16
	Unit 2.3 – Preliminary Manoeuvres of Laboratory	21
	Unit 2.4 – Disposal of Hazardous Waste	27
	Unit 2.5 – Safety Precautions and First-aid Application	31
<b>3</b>	<b>Soil Physical &amp; Chemical Analysis (AGR/N8108)</b>	<b>39</b>
	Unit 3.1 – Soil Sampling and its Procedure	41
	Unit 3.2 – Soil Testing Kit and its Applications	43
	Unit 3.3 – Soil Physical Analysis	45
	Unit 3.4 – Soil pH and EC Determination	52
	Unit 3.5 – Determination of Micro and Macro-nutrients in Soil	55
	Unit 3.6 – Cation Exchange Capacity	70
	Unit 3.7 – Reclamation of Soil	73
<b>4</b>	<b>Water Analysis (AGR/N8109)</b>	<b>77</b>
	Unit 4.1 – Determination of Water pH and EC	79
	Unit 4.2 – Determination of Water Soluble Salts	81
	Unit 4.3 – Determination of Dissolved Chemicals in Water	85
<b>5</b>	<b>Soil Health Card (AGR/N8110)</b>	<b>97</b>
	Unit 5.1 – Nutrients Required and their Analysis	99
	Unit 5.2 – Management of Fertiliser and Micro-nutrients	107
	Unit 5.3 – Soil Amendment and Integrated Nutrient Management	112
	Unit 5.4 – Soil Health Card Portal Management	121
<b>6</b>	<b>Supervision and Training of Lab Assistant in Good Lab Practices (AGR/N8111)</b>	<b>133</b>
	Unit 6.1 – Monitor and Guide the Activities of the Lab Assistant	135
	Unit 6.2 – Equipment Calibration and Maintenance	138
	Unit 6.3 – Basic Terms and Standard Solution Preparation	142



## Table of Contents

S.No.	Modules and Units	Page No.
	Unit 6.4 – Soil Health Card Portal Registration	145
	Unit 6.5 – Communication and Good Lab Practice	150
<b>7</b>	<b>Soft Skills, Computer and Financial Literacy</b>	<b>155</b>
	Unit 7.1 – Basic Communication and Organisation Skills	157
	Unit 7.2 – Types of Important Documents	161
	Unit 7.3 – Basic Computer and Financial Literacy	163
<b>8</b>	<b>Employability and Entrepreneurship Skills</b>	<b>167</b>
	Unit 8.1 – Personal Strengths and Value Systems	171
	Unit 8.2 – Digital Literacy: A Recap	185
	Unit 8.3 – Money Matters	189
	Unit 8.4 – Preparing for Employment and Self Employment	196
	Unit 8.5 – Understanding Entrepreneurship	204
	Unit 8.6 – Preparing to be an Entrepreneur	224











# 1. Introduction

Unit 1.1 – About the training programme

Unit 1.2 – Types of soils and nutrients

Unit 1.3 – Soil-water test and integrated nutrient management

Unit 1.4 – About the job role - soil and water testing lab analyst



## Key Learning Outcomes



**At the end of this module, you will be able to:**

- Manage the general discipline in the laboratory.
- Identify the types of soils and nutrients.
- Explain the importance of Integrated Nutrient Management (INM).
- Recognise the role of Soil and Water Testing Lab Analyst.

## UNIT 1.1: About the Training Programme

### Unit Objectives

**At the end of this unit, you will be able to:**

- Outline the overview of the training programme.
- Develop behavioural etiquette and technical instructions during the entire training programme.

### 1.1.1: Overview of the Training Programme

**The training curriculum will help the participants to:**

- Handle the organisational and customer service functions sensibly.
- Meet the safety needs of the lab.
- Guide the lab assistant in collecting the sample.
- Identify and understand how to operate various equipment and relevant system for operation.
- Acquire basic communication and good interpersonal skills.
- Maintain a safe and secure working environment.
- Ensure that the guidance given to the lab assistants with special needs are in accordance with the laboratory guidelines.

### 1.1.2: Participant Guidelines

**While undergoing training, participants are expected to:**

- Behave in a professional and ethical manner.
- Use intellectual and analytical abilities to enhance in the profession as a Soil and Water Testing Lab Analyst.
- Take an initiative to learn more from the training.
- Improve communication, decision making and leadership skills, thereby gaining self-confidence related to their professional and social behaviour.
- Complement formal training with innovative skills and self-motivation.
- Retrieve and use relevant information.
- Use diagnostic skills to identify problems and find possible solutions.
- To develop an analytical sense of questioning, with the aim of improving procedures and productivity.

## UNIT 1.2: Types of Soil and Nutrients

### Unit Objectives

At the end of this unit, you will be able to:

- Explain the types of soil and nutrients required for the plant growth.

### 1.2.1: Different Types of Soil

#### 1. Alluvial Soil:

Alluvial soil is a fine-grained fertile soil deposited by water flowing over flood plains or in river beds and are formed due to erosion of uphill soil due to downstream of water.

Alluvial soil is rich in Potassium but deficient in Nitrogen and Phosphorus.



#### 2. Black Soil:

The black soil is formed by the weathering and cooling of lava (igneous rocks) after a volcanic eruption.

Black soil is very rich in the iron also contain high quality of magnesia, lime and alumina.



#### 3. Red and Yellow Soils:

Red soils are generally derived from crystalline rock. They are usually poor growing soils, low in nutrients and humus and difficult to cultivate because of its low water holding capacity.

Yellow soil is a soil formed under broad-leaved forests in humid subtropical regions. Yellow color is caused by the presence of ferric hydroxide. Yellow soil has a small supply of nutrients and requires large quantities of fertilizers.



#### 4. Laterite Soil:

Laterite, soil layer that is rich in iron oxide and derived from a wide variety of rocks weathering under strongly oxidizing and leaching conditions. It contains the iron oxide minerals goethite  $\text{HFeO}_2$ , lepidocrocite  $\text{FeO}(\text{OH})$  and hematite  $\text{Fe}_2\text{O}_3$ .



**5. Arid and Desert Soils:**

Arid soil or soil in the arid regions are formed due to the significant temperature changes along with the water deficiency and chemical weathering of the rock. Arid soils typically contain high levels of calcium carbonates, gypsum, as well as sodium.



**6. Saline and Alkaline Soils:**

When the soil contains excess of sodium salts and clay complex still contains exchangeable calcium, the soil is known as saline soil or white alkali or brown alkali soil. In the case of alkali soils, the exchange complex contains appreciable quantities of exchangeable sodium. Such soils may or may not contain excess salts.



**7. Peat and Marshy Soils:**

Peaty and marshy soils originate in the humid regions due to the accumulation of large amount of organic matter in the soils. These are generally submerged under water during the rainy season. The soils are black, heavy, highly acidic and contain rich organic matter but deficient in phosphate and potash.



**8. Forest and Mountain Soils:**

Mountain soil are formed by the mechanical weathering of rock due the disintegration caused by the snow, rain, radiation etc. The property of the soil is heterogeneous in nature, rich in humus and deficient in the potash, phosphorous and lime.



Fig: 1.2.1 (a) Different Types of Soil

**1.2.2: Types of Macro and Micro Nutrients found in Soils**

Macro-nutrient Elements	Micro-nutrient Elements
• Nitrogen (N)	• Iron (Fe)
	• Chlorine (Cl)
• Phosphorus(P)	• Manganese (Mn)
	• Molybdenum (Mo)
	• Copper (Cu)
• Potassium (K)	• Calcium (Ca)
	• Magnesium (Mg)
	• Zinc (Zn)

Fig: 1.2.2 Macro and Micro Nutrients

## UNIT 1.3: Soil-Water Test and Integrated Nutrient Management

### Unit Objectives

At the end of this unit, you will be able to:

- Explain the importance of soil and water testing.

### 1.3.1: Significance of Soil and Water Testing

#### Soil Analysis or Testing:

A soil analysis is a process by which elements such as P, K, Ca, Mg, Na, S, Mn, Cu and Zn are chemically extracted from the soil and measured for their “plant available” content within the soil sample.

#### Water Testing:

Once the source of water is identified, water to be used for irrigation should be tested to determine the quality of the water to be used for irrigation, to aid in the choice of fertilisers for optimum plant growth, and to minimise the risk of discharging pollutants to surface or ground water.

The significance of soil and water testing is given below:

- It helps to know the nutrient status of the soil.
- It helps to prevent over/under use of fertilizers.
- It helps to predict the nutritional values needed for crop production.
- Water testing helps us to understand the quality and potability of water.



Fig: 1.3.1 Planting after the Soil and Water Analysis



## UNIT 1.4: About the Job Role-Soil and Water Testing Lab Analyst

### Unit Objectives

**At the end of this unit, you will be able to:**

- Discuss about the role of Soil and Water Testing Lab Analyst.
- Know the general discipline in the laboratory.

### 1.4.1: Roles and Responsibilities of the Lab Analyst

**Following are the roles and responsibilities of the Lab Analyst:**

- The lab analyst supervises lab assistant for proper upkeep of the laboratory equipment.
- The lab analyst will assist in the logistics and coordination of experiments along with the observations being carried out in the laboratories.
- The lab analyst supervises the laboratory assistant to ensure that the laboratory is stocked with the necessary supplies or not.
- The lab analyst helps the lab assistant in maintaining the departmental lab records as required.
- The lab analyst supervises the lab assistant to keep laboratory floor dry and clear of all objects.
- The lab analyst supervises the lab assistant and the participants in wearing the Personnel Protective Equipment (PPE) in the laboratory.
- The lab analyst performs the recommendations of the fertilisers and other parameters in the Soil Health Card.
- The lab analyst monitors the data taken down by the lab assistant.

### 1.4.2: General Discipline in the Laboratory

**Following are the general disciplines to be followed in a laboratory:**

- Switch off all the mobile phones or keep them in silent mode.
- Immediately place all the reagent bottles to their respective shelves after use.
- Do not through the waste filter paper, burned up matchsticks etc into the sinks.
- Immediately report to the supervisor or lab assistant if there are any breakages of apparatus, accidents or injuries occur.
- Do not eat, drink, smoke or make any unnecessary noise in the laboratory.
- Carry out only the authorised experiments.
- Handle the electrical and electronic equipment with care.
- Switch off water, gas and electricity supplies before leaving the laboratory (unless otherwise specified by the supervisor).
- Be aware of the location of all fire-fighting equipment and learn how to operate them.
- In an emergency, the technician-in-charge has the authority to evacuate the area. Evacuation orders must be followed.
- Report all accidents and damages to the technician-in-charge or the departmental safety representative.

**Exercise** 

**Briefly answer the following questions:**

1. List the different types of soil.

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2. What are the different types of macro and micro-nutrients found in the soil?

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3. Explain the significance of soil and water lab testing.

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4. Define the responsibilities of Soil and Water Testing Lab Analyst.

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Notes



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