

**COMPETENCY BASED CURRICULUM**

**FOR THE MODULES OF**

**SOIL TESTING TECHNICIANS**  
**(Agriculture Sector)**

**UNDER**

**SKILL DEVELOPMENT INITIATIVE (SDI) SCHEME**

**Based on**

**MODULAR EMPLOYABLE SKILLS (MES)**



**GOVERNMENT OF INDIA**  
**MINISTRY OF SKILL DEVELOPMENT AND ENTREPRENEURSHIP**  
**DIRECTORATE GENERAL OF TRAINING**

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## 1. INTRODUCTION

The Ministry of Skill Development and Entrepreneurship is an apex organization for the development and coordination of the vocational training including vocational training for women in our country. The Ministry conducts the training programmes through the Craftsmen Training Scheme (CTS), Apprenticeship Training Scheme (ATS), Skill Development Initiative (SDI) Scheme based on Modular Employable Skills (MES), and Craftsmen Instructor Training Scheme (CITS) to cater to the needs of different segments of the Labour market. The National Council for Vocational Training (NCVT) acts as a central agency to advise Government of India in framing the training policy and coordinating vocational training throughout India.

A majority of Indian workforce does not possess marketable skills which is an obstacle in getting decent employment and improving their economic condition. A large number of school drop outs do not have access to skill development for improving their employability. The higher entry requirements and long duration of courses under the formal training system are some of the obstacles for a person of low educational attainment to acquire employable skills.

The Ministry is implementing the Skill Development Initiative (SDI) Scheme based on Modular Employable Skills (MES) to provide vocational training to early school leavers and existing workers especially in the unorganized sector to develop skilled manpower for the industry. Training is provided by registered Vocational Training Providers (VTPs) under the Government, Private Sector, and Industrial establishments located all over the country. Testing of skills acquired informally by an individual are directly tested on pre-determined parameters through independent Assessing Bodies. Nationally as well as internationally recognized NCVT certificate is issued to every successful individual.

The key features of the Modular Employable Skills (MES) are:

- Short-term training programmes designed in consultation with the Industry.
- Identification of “minimum skills set” sufficient to get employment.
- Flexible training delivery mechanism (part time, weekend, or full time).
- Different levels of programmes (Foundation level to advanced level).
- Opportunity for lifelong learning.

The training under MES would benefit different target groups like workers seeking certification of their skills acquired informally, workers seeking skill up gradation, and early school dropouts and unemployed. Central Government facilitates and promotes the training while registered Vocational Training Providers (VTP) under the Govt. and Private Sector provide the training. Testing of skills is done by independent Assessing Bodies to ensure impartiality.

The National Skills Qualification Framework (NSQF), published in the Gazette of Government of India on 27th December, 2013, is a national framework that aims to integrate general and vocational streams of education and training. The main thrust of the NSQF is to focus on competency-based qualifications. The National Skill Development Agency (NSDA) under the Ministry is responsible for the implementation of the Framework, by bringing together the key stakeholders through the National Skill Qualifications Committee (NSQC).

The competency-based framework organizes qualifications into ten levels, with the entry level being 1, and the highest level being 10. Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are (1)

Process, (2) Professional knowledge, (3) Professional skill, (4) Core skill, and (5) Responsibility. The paradigm shift from learning focused on inputs to an outcome/competency-based education would help in the Recognition of Prior Learning (RPL), and simultaneously enable the alignment of the Indian qualifications with international ones. Government funding is expected to be on a preferential basis for NSQF compliant courses. The NSQF notification provides a Qualification Register, which is the official national database of all qualifications aligned to NSQF levels. Through this Register, learners can expect access to all NSQF compliant qualifications.

The Ministry has set up Mentor Councils to focus on courses under NCVT in various sectors with representation from thought leaders among different stakeholders viz., industries, innovative entrepreneurs who have proved to be game-changers, academic/professional institutions, and champion ITIs for each of the sectors. The Mentor Council for each sector reviews curricula, admission criteria, course duration, and requirement of trainers and assessment/evaluation systems for the sector on a continuous basis and make recommendations regarding the same. Sector-wise Core Groups are formed to plan and prepare the documentation for the competency-based curricula for the courses under each sector.

## 2. GENERAL DISCRIPTION AND COURSE STRUCTURE

Qualification	-	<b>SOIL TESTING TECHNICIAN</b>
MES Code No.	-	
NSQL Level	-	Level 03
Duration of modular training	-	300 hrs
Entry qualification	-	Minimum 12th standard pass with science
No. of trainee per unit	-	25

### Distribution of training on hourly basis:

Sl. No.	Broad theory & practical component to be covered	Duration
1	<b>Theory:</b> Importance of soil testing in agriculture for successful crop production, some basic principles of analytical chemistry and working principles of instruments used for soil testing, importance of plant nutrients, Based on soil testing results, balanced fertilizer application for successful crop production	100 hrs
2.	<b>Practical:</b> Collection of uniform, representative soil sampling from the farmer's field. Preparation of primary and secondary standard solutions. Estimation of soil pH and EC, organic carbon, available nitrogen, phosphorus, potassium and sulphur, micronutrients, lime requirement for acidic soils and gypsum requirement for salt affected soils. Operation of analytical instruments (colorimeter, spectrophotometer, Flame photometer, atomic absorption spectrophotometer).	150 hrs
3.	<b>SOFT SKILLS:</b> Personal hygiene, Stress free work management.	50 hrs
	<b>Total</b>	300 hrs

### **3. JOB ROLES**

#### **Brief description of Job roles:**

- 1- Analyse soil samples of the farmer's fields and can provide balanced fertilizer dose for successful crop production to be taken by the farmers and run it profitably.
- 2- Collect the uniform, representative soil samples from the farmer's fields.
- 3- Convince the farmers for soil health improvement by advising the correct soil amendment of problematic soils.
- 4- Suggest organic sources of plant nutrients based on soil testing results

## 4. NSQF LEVEL COMPLIANCE

The Broad Learning outcomes of Soil Testing Technician trade under MES matches with the Level descriptor at Level-03.

The NSQF level- 3 descriptor is given below:

LEVEL	Process required	Professional knowledge	Professional skill	Core skill	Responsibility
Level 03	Person may carry put a job which may require limited range of activities routine and predictable	Basic facts, process and principle applied in trade of employment	Recall and demonstrate practical skill, routine and repetitive in narrow range of application	Communication written and oral, with minimum required clarity, skill of basic arithmetic and algebraic principles, personal banking, basic understanding of social and natural environment	Under close supervision Some Responsibility for own work within defined limit.

## **5. GENERAL TRAINING PLAN, ASSESSMENT & CERTIFICATE**

### **General Training Plan**

The knowledge and skill components as stated in the section for 'learning outcomes' are to be imparted in accordance with the instructions in respect of the content and time structure.

### **Assessment**

The competency assessment for the Modular Employable Skills under the SDI scheme is being done by the assessor of the independent Assessing Bodies (AB) which is not involved in training delivery, to ensure an impartial assessment. The assessment process through Assessing Bodies aims to test and certify the competency of the persons who seek certification of their skills acquired informally or the persons who have been trained at the registered VTPs. In the assessment process, identification of competency, ways to measure the competency and deciding on the type of evidence that has to be collected are the responsibility of the Assessing Bodies whereas administering the assessment and collecting the evidence and reporting the results are the responsibility of the assessors.

Candidates are to demonstrate that they are able to:

1. Plan and organize work processes, identify necessary materials and tools;
2. Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
3. Apply professional knowledge and soft skills& entrepreneurship while performing the task.
4. Check the job for accuracy, identify and rectify errors in job.

The details of the assessment standard are as per section-13.

### **Pass regulation:**

Minimum passing marks for Practical is 60%

Minimum pass marks for theory is 40% (theoretical test will be based on viva or oral questions)

### **Certificate**

Successful persons will be awarded certificates issued by National Council for Vocational Training (NCVT).

## 6. LEARNING OUTCOMES

The following are minimum broad learning outcomes after completion of the **Soil Testing Technicians** course of **130 hrs duration**:

### A. GENERIC OUTCOME

1. Maintain personal hygiene and health.
2. Handle personal finance and work related stress.
3. Communicate with clarity and conduct appropriately with co-workers/  
women/employers/visitors.

### B. SPECIFIC OUTCOME

4. Demonstrate sampling technique, analytical procedure for each parameter.
5. Test and record the soil nutrients levels present in soil at different ratings for fertilizer recommendations
6. Prescribe fertilizer doses for successful crop production based on soil nutrient levels.

***NOTE: Learning outcomes are reflection of total competencies of a trainee. Each learning outcome may include multiple assessment components. However assessment will be carried out as per assessable outcome and assessment criteria.***

## 7. ASSESSABLE OUTCOMES WITH ASSESSMENT CRITERIA

### Note:

1. The training shall be conducted as per the syllabus.
2. The trainee shall demonstrate the competencies which are defined below in assessable outcome and assessment criteria.
3. All the assessable outcomes are to be tested during formative assessment, observations, and viva-voce.
4. Assessable outcome of Soft skills & entrepreneurship shall be tested separately and also be applied in Theory and Practical examinations.
5. These assessable outcomes and assessment criteria will serve as a set of guidelines for Trainers and Assessors.

### GENERIC ASSESSABLE OUTCOME:

ASSESSABLE OUTCOMES	ASSESSMENT CRITERIA
1. Maintain personal hygiene and health	1.1 Demonstrate knowledge of health and personal hygiene.
	1.2 Observe personal hygiene in day to day work.
2. Handle personal finance and work related stress.	2.1. Explain some ideas on stress free working
	2.2. Manage personal finance for personal growth. 2.3. Perform yoga and meditation for stress free work.
3. Communicate with clarity and conduct appropriately with co-workers/ women/employers/visitors.	3.1. Show sensitivity to ethics and values of poultry farming.
	3.2. Communicate with clarity with others 3.3. Show respect to co-workers/ women.

### SPECIFIC ASSESSABLE OUTCOME

ASSESSABLE OUTCOME	ASSESSMENT CRITERIA
1. Demonstrate sampling technique, analytical procedure for each parameter.	4.1. Demonstrate representative and uniform soil samples.
	4.2. Demonstrate sampling technique.
	4.3. Ascertain the proper sampling tools.
	4.4. Analyse the different nutrients in soil samples as per the standard methods.
2. Test and record the soil nutrients levels present in soil at different ratings for fertilizer	5.1. Test the soil nutrients levels in different soil types

recommendations	5.2. Based on the soil test rating, recommend the fertilizer doses as per the ready recknors chart.
	5.3. Maintain and properly operate various instruments required for soil analysis.
3. Interpretation of test results and suggestion for fertilizer application	6.1. Interpret the soil testing results and calculate the fertilizer doses required for various crops with organic and inorganic sources.
	6.2. Suggest suitable fertilizers for soil application

## 8. SYLLABUS CONTENT WITH TIME STRUCTURE

### 8.1 FOR THE MODULE OF SOIL TESTING TECHNICIAN

(Module Code No.     )

**Duration: 130 hrs.**

**Detailed Syllabus:**

Practical Competencies	Underpinning Knowledge (Theory)	DURATION IN HRS.	
		Practical	Theory
Collection of soil samples from the farm's field Processing of soil samples for analysis Preparation of standard solutions for different strength. Preparation of primary and secondary solutions. Estimation of soil pH and interpretation of results Estimation of electrical conductance in soil and interpretation of results Estimation of organic carbon in soil sample and interpretation of result Working principle of automatic N distillation apparatus their standardization and application. Working principles of colorimeter with UV spectrophotometer, their calibration and application. Working principles of flame photometer, their calibration and application. Working principle of atomic absorption spectrophotometer) their calibration and application. Estimation of available N in soil; samples and interpretation Estimation of available P and interpretation Estimation of available K and interpretation Estimation of available sulphur and interpretation in soil samples. Estimation of available micro nutrients Fe, Cu, Mn Zn in soil Determination of lime requirement and interpretation Estimation of gypsum requirement of problem soils and interpretation	Importance of soil testing, Collection of uniform representative soil sampling and processing for analysis, , some basic principles of analytical chemistry working principles of instruments used for soil testing, calibration and application of instruments, importance of major and minor nutrients included in essential plant nutrients, results of analysis and interpretation, soil test based fertilizer recommendation for the crops.	150 hrs	100 hrs
<b>SOFT SKILLS (10hrs.)</b>			
<b>Generic Skills</b>	<b>Oral Communication</b>		
	The individual Should be		

	able to: a) Listen carefully and understand requirement b) Orally communicate to others effectively		
<b>Professional Skills</b>	Ability to follow instruction and carry work accordingly.		
	<b>Organize</b>		
	Ensure the day works and deliver as per the time.		
	<b>Behavioural Conduct</b>		
	Use appropriate language to deal with co-workers/ women/ employers/visitors		
	Keeping work area clean		
	<b>Team Working</b>		
	The user / individual needs to know working with a team		
<b>PERSONAL HYGIENE:</b>	Awareness on AIDs & Precautionary measures. Awareness on ill effects on using Alcohol & chewing Tobacco products. Upkeep of Uniform. Dietary guidance. PPT / Film Shows on AIDS, Smoking & Alcoholism.		
<b>STRESS MANAGEMENT:</b>	Need for stress management. YOGA & its effects of Body & Mind. Need for Meditation/Methods of Meditation. Practice YOGA & Meditation.		
<b>PERSONAL FINANCE MANAGEMENT:</b>	Management of personal expenses. Need to Cultivate habit of Savings for future needs. Knowledge on various general and personal Insurance Knowledge on Various saving schemes available with nationalized bank. Knowledge on Personal Finance Management		

## 9. INFRASTRUCTURE

1. Instructors' Qualification	Master degree in Soil Science & Agricultural Chemistry
2. Desirable qualification	BSc (Ag) with three experience in soil testing services
3. Space Norms	235 m <sup>2</sup>
4. Power Norms	2.00 Kw
5. Tools, Equipment & General Machinery	As per Annexure I

NOTE: \* MoU with an organization having Driving Tracks in minimum 5 Acres land is allowed for sharing and optimal utilization of Driving Track. The same track to be available during testing of candidates.

For imparting soft skills guest/ contract faculty (**MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience**  
**OR**  
**Graduate/ Diploma with Two years experience and trained in Employability Skills from DGET institutes**  
**AND**  
**Must have studied English/ Communication Skills and Basic Computer at 12<sup>th</sup> / Diploma level and above**) may be engaged.

## **10. ASSESSMENT STANDARD**

### **10.1 Assessment guideline:**

The trainer/assessor should ensure appropriate arrangements are for assessment and appropriate resources are available for undertaking such assessment. The nature of special needs should be taken into account while undertaking assessment.

The following marking pattern to be adopted while assessing:

**(a)** Weightage in the range of 60-75% to be allotted during assessment under following performance level:

For performance in this grade, the candidate with occasional/frequent guidance and showing due regard for safety procedures and practices, has attained driving skills which demonstrates reasonable standard set forth.

In this work there is evidence of:

- Demonstration of good Driving skills on vehicles with different configurations.
- Below 70% accuracy achieved while undertaking different skills demanded by the set standards.
- A fairly good level of neatness and consistency in handling controls.
- Occasional support in completing the project/job.

**(b)** Weightage in the range of above 75%- 90% to be allotted during assessment under following performance level:

For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has attained driving skills which demonstrates reasonable standard set forth.

In this work there is evidence of:

- Good skill levels in Driving skills on vehicles with different configurations
- 70-80% accuracy achieved while undertaking different skills demanded by the set standards.
- A good level of neatness and consistency in handling controls.
- Little support in completing the job.

**(c)** Weightage in the range of above 90% to be allotted during assessment under following performance level:

For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and

practices has attained driving skills which demonstrates reasonable standard set forth.

In this work there is evidence of:

- High skill levels in the use of Driving skills on vehicles with different configurations.
- Above 80% accuracy achieved while undertaking different skills demanded by the set standards.
- A high level of neatness and consistency in handling controls.
- Minimal or no support in completing the job.

## 10.2 EXTERNAL ASSESSMENTS

COM. NO.	ASSESSABLE OUTCOME	ASSESSMENT RESULT
<b>GENERIC</b>		
1.	Maintain personal hygiene and health.	
2.	Handle personal finance and work related stress.	
3.	Communicate with clarity and conduct appropriately with co-workers/ women/employers/visitors.	
<b>SPECIFIC</b>		
4.	Demonstrate sampling technique, analytical procedure for each parameter.	
5.	Test and record the soil nutrients levels present in soil at different ratings for fertilizer recommendations	
6.	Prescribe fertilizer doses for successful crop production based on soil nutrient levels.	
	<b>External Assessment Result</b>	<b>100</b>

## 11. LIST OF TRADE COMMITTEE MEMBERS

<b>Sl. No.</b>	<b>Name &amp; Designation Shri/Mr./Ms.</b>	<b>Organization</b>	<b>Designation</b>
<b>1.</b>	Dr. Priyanka Shukla, CEO, CSSDA	Chhattisgarh State Skill Development Authority, Raipur (C.G.)	Chairperson
<b>2.</b>	Shri H.V. Samvatsar , Director, CSTARI	CSTARI, Kolkata	Member
<b>3.</b>	Shri L.K. Mukherjee, Deputy Director, CSTARI	CSTARI, Kolkata	Member
<b>4.</b>	Shri N. Nath, Asst. Director	DGT (CSTARI)	Member
<b>5.</b>	Shri J.R. Mathur, Asst. Advisor	RDAT Kanpur	Member
<b>6.</b>	Shri Phool Chandra, ADT	RDAT Kanpur	Member
<b>7.</b>	Shri Suneel Yadav, Asst. Director	Chhattisgarh State Skill Development Authority, Raipur (C.G.)	Member
<b>8.</b>	Dr. Jagpal Singh Bal, Deputy CEO	State Project Livelihood College Society (SPLCS), Raipur (C.G.)	Member
<b>9.</b>	Dr. S. Patel, Professor	IGKV, Raipur	Member
<b>10.</b>	Dr. V.N. Mishra, Professor	IGKV, Raipur	Member
<b>11.</b>	Dr. R.K. Bajpai, Professor & Head Dept. of Soil Science & Agriculture	IGKV, Raipur	Member
<b>12.</b>	Dr. Ajay Verma, Professor	IGKV, Raipur	Member
<b>13.</b>	Mohd. Quasin, Associate Professor	IGKV, Raipur	Member
<b>14.</b>	Dr. Renu Jha, Associate Professor (Bo-technology)	IGKV, Raipur	Member
<b>15.</b>	Dr. D. K. Roy, Asstt. Professor	IGKV, Raipur	Member
<b>16.</b>	Gajendra Chandrakar, Scientist	IGKV, Raipur	Member
<b>17.</b>	Dr. K.K. Shrivastava, P. Scientist	IGKV, Raipur	Member

**MODULE: Soil Testing Technician****LIST OF TOOLS & EQUIPMENTS FOR 25 TRAINEES**

Sl. No	Description	Quantity
1.	Analytical top loading balance	01
2	pH meter	03
3.	EC meter	03
4	Flame photometer	02
5	UV double beam Spectro- photometer	02
6	N distillation unit (Automatic)	02
7.	Hot air Oven	01
8.	Mechanical rotary shaker	02
9.	Atomic Absorption Spectro- photometer	01
10	Distilled water unit	02
10.	Computer, with printer	01
11	Refrigerator 250 litre	01
12	Glasswares for all analysis burette, pipette, beakers, volumetric flasks, storage bottles, water bottles etc as per requirements	
13	Chemicals for all reagents as per requirements	

**Detail specification for different Items required for Soil Testing Laboratory:**

1	<p><b><u>Analytical top loading balance (0.0001 g) precision</u></b>  Electronic analytical top loading Balance (0.0001 g) precision  Weighing range : 220g  Calibration: Built in &amp; automatic.  Readability : 0.1 mg  Linearity : <math>\pm 0.2</math> mg  Reproducibility : <math>\leq 0.1</math> mg  Display : LCD [ Liquid Crystal Display]  - UNI block/ mono block/ monolithic cell weighing technology  - Bi-directional RS-232 data interface port  - Overload protection  - Levelling feet; level indicator  <b>Note – Supplier/ Manufacturer should ensure the weighing and measuring equipment must comply with the legal metrology act 2009</b></p>
2	<p><b><u>Microcontroller based pH System with electrode &amp; Temp. probe (Auto Temp. Compensation, 3 point calibration, Resol. 0.001 pH)</u></b>  Microcontroller based.  Measures pH, mV-Absolute, mV-Relative and temperature  3- point calibration for pH  2 Combination of calibration for pH can be stored and recalled  Automatic &amp; Manual temp compensation for pH  50 or more readings of pH can be stored in battery back-up memory and retrieved through a printer  alphanumeric display  Soft touch numeric and functional keys.  Facility to measure slope of electrode.  <b><u>Specifications :</u></b></p>

	<p>pH Range : 0 to 14 pH.          Milli volt Range : 0 to +/- 1999.9 mV.          Temperature range : 0 to 99.9 Degree Celsius          Resolution : pH : 0.001 pH          Milli volt: 0.1 mV.          Temperature: 0.1 Degree Celsius.          Relative accuracy for pH : : <math>\pm 0.002</math> pH <math>\pm 1</math> digit          Stability: 0.002 pH per hour.          Display: alphanumeric LCD.          Power Supply: 230 V AC +/- 10%, 50 Hz.          Supplied Accessories : 0/14 pH Special combined Electrode,          Temperature probe          Electrodes stand          Printer port 25 pin D type Epson compatible.          Instruction Manual.</p>
3	<p><b><u>Microprocessor Based Conductivity Meter with Cells (1.0CC &amp; 0.1CC) and Temp. probe.</u></b>          Specifications :  <b><u>Conductivity</u></b>          Range: 0.1 /uS to 100 mS. (6 decadic ranges).          Accuracy: <math>\pm 1\%</math> of F.S. <math>\pm 1</math> digit.  <b><u>TDS</u></b>          Range: 0.1 ppm to 100 ppt. (6 decadic ranges).          Accuracy: <math>\pm 1\%</math> of F.S. <math>\pm 1</math> digit.  <b><u>Temperature</u></b>          Range : 0 Degree Celsius to 100 Degree Celsius          Resolution : 0.1 Degree Celsius          Accuracy : <math>\pm 0.2</math> Degree Celsius <math>\pm 1</math> digit  <b><u>Other features required</u></b>          Cell Constant : Acceptable from 0.1 to 5.0          Auto temp. Compensation: 0 Degree Celsius to 100 Degree Celsius with PT 100 sensor.          Manual temp. Compensation: 0 Degree Celsius to 60 Degree Celsius user selectable.          Conductivity temp. Co-efficient: 0.0% to 9.9% user selectable.          Display : (3 digits for TEMP/TEMPCO, 4 Digits for Conductivity/TDS). With automatic decimal point selection.          TDS-factor: 0.00 to 9.99 user selectable.          Power requirement: 230V AC, +/-10%, 50 Hz.          Standard Accessories :          Conductivity Cell, Cell constant 0.1          Conductivity Cell, Cell Constant 1.0          Temperature probe (PT-100 sensor)          Stand &amp; Clamp, Instruction Manual.</p>
4	<p><b><u>Microprocessor based Flame Photometer with Na, K filters and Compressor.</u></b>  <b>FEATURES</b>          Micro processor based          Upto four elements measured with single aspiration.          Automatic filter selection          Curve fittings for non linear ranges ( upto 5 standard)</p>

	<p>Records kept of Date and Time of Analysis  Saved setup cut operation steps.  4-Line ,20 Character alphanumeric LCD READOUT  Centronics printer port for Epson compatible dot matrix/Inkjet5 and Laser printers  Oil free Compressor with built in Air filter and Air Regulator  RS-232 Interface (Optional)  <b>SPECIFICATIONS</b>  <u><b>Range of operation :</b></u>  Na 10 ppm 100 ppm.  K 10 ppm. 100 ppm.  Li 2 ppm. 50 ppm.  Ca 100 ppm. 300 ppm.  Curve fit software is provided for high concentrations mode.  <u><b>Full Scale Sensitivity :</b></u>  Na: 2 ppm K : 1 ppm Li : 1 ppm Ca : 30 ppm.  <u><b>Minimum Detectable Limit :</b></u>  Na: 0.2 ppm K : 0.1 ppm Li : 0.1 ppm Ca : 3 ppm.  Filters (10 nm Typical) : Na and K supplied  Reproducibility: Low Conc.:+ 1% f.s.; High Conc.: + 2% f.s.  Operating Air pressure : 0.45 kg / cm<sup>2</sup> (typical)  Oil free Air Compressor: With built-in air regulator and air filter to deliver stable and moisture/oil free air supply.  Fuel Gas :LPG  Power Supply: 230 V AC +/- 10%, 50 Hz.  <b>OPTIONAL :</b>  Calcium Filter.  Lithium Filter</p>
5	<p><b><u>Smart UV-VIS Spectrophotometer (Double Beam &amp; Graphic LCD).</u></b>  <b><u>Bandwidth 2.00 nm</u></b>  Optics: Double Beam optics, Modified Czerny-Turner Monochromator geometry for better aberration correction. Holographic diffraction grating with 1200 lines/mm blazed at 250nm.  Control: Micro Controller Base.  Wavelength  Range: 200 to 1100nm.  Accuracy : +/-0.5nm  Repeatability: +/-0.2nm.  Resolution : +/-0.1nm  Bandwidth : 2.0nm  Photometric  Range: +/-2.5Abs.  Accuracy: +/-0.005Abs at 1.0Abs.  Repeatability: +/-0.002Abs at 1.0Abs.  Stray Light: Less than 0.05%T at 220nm and 370nm.  Scan Speed : Slow, Medium, Fast  Data Interval: Depends on wavelength scan range and scan speed; Minimum possible 0.1nm for slow, 0.2nm for medium and 0.4nm for fast scan speeds.  Sample Holder : 5-position automatic positioning, for 10mm sample cuvettes and 1 fixed position for 10mm Ref. Cuvette.</p>

	<p>Source : (1) Tungsten-Halogen lamp (Preferred usage 320nm to 1100nm)  (2) Deuterium lamp (Preferred usage 200nm to 320nm)  Detector: Photo Diode.</p>
6	<p><b><u>Automatic Nitrogen Analyser for determination of Total &amp; Available Nitrogen</u></b></p> <p><b><u>Automatic Distillation System</u></b>  Auto-sequencing Programmable Microprocessor based Distillation with inbuilt software,  Colour Touch Screen high resolution TFT LCD Display, Large 4.3" screen  Auto Intelligent run of programmable steps, Addition of Boric Acid, Dilution, KMNO<sub>4</sub> Addition for Available Nitrogen, Alkali Addition, Steam Processing, Residue Removal, Process over indication with alarm with inbuilt delay time features, Automatic Titration Connectivity feature for future upgradation, Aspiration of Receiver Residue.  Flow diagram display to show live auto sequencing steps at each stage of process, Data table export to excel  Facility to program and control distillate volume for determination of available nitrogen  Auto sensing of no water condition in condenser &amp; steam generator with alarm &amp; signal to alert user &amp; Auto deactivation of operation in case of user non availability  Enables automatic monitoring and measuring of high temperature in distillate with auto warning signal and safety alarm. Continuously measured temperature is displayed digitally.  Auto door open warning indication, Auto tube insert error indication. Auto deactivation of System on error diagnosis, Adjustable steam power, Auto online water saving mechanism, Auto reagent Level Sensor with Alarm for Reagents, Stainless steel non corrosive steam Generator  Inbuilt Automatic Printer for direct print out of results without connecting to PC.  Automatic calculation of results on input of titre value in terms of percentage of Protein/N<sub>2</sub>.  Automatic water level monitoring &amp; Peristaltic pump for reagents addition.</p> <p>Company should have good track record of 10 years with proof of supply.  The instrument shall strictly confirm to the specifications with relevant brochure. ISO / CE Certified.  The company should be reputed supplier, not be blacklisted &amp; should not have any adverse remarks.  Spares should be made available for minimum period of 10 years after the warranty period.</p>
07	<p><b><u>HOT AIR OVEN..( Memmert type Temperature range 250°C)</u></b>  Forced convection system ensures good mixing, strong dispersion and maintains higher temperature uniformity inside the chamber.  Synthetic door gasket made of neoprene on the double walled door.  User oriented design of shelves makes you adjust each space of shelves without difficulty.  Adjustable two ventilation slides control inner air / vapour circulation.  Beaded heating elements are placed in ribs, at bottom and sides for uniform heat</p>

	<p>distribution.</p> <p><b>Temperature Range</b> 50°C to 250°C±1°C</p> <p>Temperature controlled by digital temperature indicator cum controller in conjunction with temperature sensor.</p> <p>Uniformity maintained by air circulating fan.</p> <p>Size available : 18"x18"x18" or 24"x24"x24" or 24"x24"x36"</p>
08	<p><b>Rotary Flask Shaker ( Variable speed Horizontal</b> For shaking solution in glass flasks in Research Institutions, Workshops, Chemical &amp; Agriculture Laboratories. It is a compact bench model unit. The heavy platform is fitted with rubber discs to hold Erlen Meyer Flasks from 50 ml. to 1000 ml. capacity. The platform is mounted on ball bearing crank shafts to give an orbital circular motion to flasks. The diameter of the orbit is approximately 2". The entire assembly is mounted on a rental casing which houses a motor coupled by means of V Belt with pitch pulley. The motor supplied is of CROMPTON/AUE or equivalent make. Working on 220 volts, 1 ph, 50 cycles AC supply. Supplied complete with speed regulator, digital speed meter, digital timer and stainless steel top.</p> <p><b>Available in following capacities:-</b></p> <p>Platform Size Holding Capacity HP (Motor)</p> <p>45 cm × 45 cm supplied without clamps.</p> <p><b>Clamps for above.</b></p> <p>SS Lotus clamps for conical flasks of size. 50 or 100 ml.</p> <p>SS Lotus clamps for conical flasks of size. 150 or 250 ml.</p> <p>SS Lotus clamps for conical flasks of size. 500 ml.</p> <p>SS Lotus clamps for conical flasks of size. 1000 ml.</p>
<b>double beam Atomic Absorption Spectrophotometer</b>	
09	<p><b>Computer controlled true double beam Atomic Absorption Spectrophotometer.</b></p> <p><b>Eight Lamp automatic turret with independent eight power supplies.</b></p> <p><b>Ebert Monochromator with Wavelength range 190-900 nm. holographic Grating 1800 lines/mm. Focal length 330mm.</b></p> <p><b>Capable of wavelength location by automatic peak searching, auto loading of all parameters and auto bandwidth selection &amp; continuously variable selection 0.2-2.0 nm with D2 lamp background correction.</b></p> <p><b>Titanium burners for C<sub>2</sub> H<sub>2</sub> -N<sub>2</sub>O path length 50 mm &amp; C<sub>2</sub>H<sub>2</sub>- AIR path length 100 mm with precise knobs for burner optimization i.e. height, rotational &amp; lateral, Fully inert nebulizer.</b></p> <p><b>System with automatic flame changeover, Full safety interlock including pressure sensors on both lines, power failure protection, burner interlock and flame sensor, flame ignition should be automatic</b></p> <p><b>PTFE spray chamber and adjustable impact bead aerosol.</b></p> <p><b>PC operating AAS software embedded with able to run with MS windows software should be compliance with international quality norms and have upgradeable facility</b></p> <p><b>Suitable Computer system ISO certified and printer should be quoted. The system may also be upgraded with all major accessories. Suitable for 230V: 50/60 Hz operation.</b></p> <p><b>Single element Hollow Cathode Lamps Cu/Zn/Mn/Fe/</b></p>

	<p><b>Ni/Cr/Ag/Cd/Sn/Pb/Mg/Na etc.</b></p> <p><b>Software: System should have facilities of repeat of result of same sample. &amp; data treatment . Automatic calculation of percentage in base material.</b></p> <p><b>ACCESSORIES : Acetylene and Nitrous Oxide cylinder with regulator, air compressor, air filter, voltage stabilizer Spares and consumables for 2 years operations.SS Exhaust Fume Hood with inert centrifugal blower, Instruction manual &amp; Circuit diagram to be provided.</b></p> <p><b>Optional : Vapour Generation Accessory -for ppb level of Arsenic, Mercury, Selenium,</b></p> <p><b>Antimony and other Hydride forming elements.</b></p> <p><b>Warranty period : One year warranty period for complete system</b></p>
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**Distilled water apparatus: All glass horizontal apparatus cap 3 litres per hour**

**GUIDELINES FOR INSTRUCTORS AND ASSESSORS**

1. Due care to be taken for proper & inclusive delivery among the batch. Some of the following method of delivery may be adopted:

- A) LECTURE
- B) LESSON
- C) DEMONSTRATION
- D) PRACTICE
- E) GROUP DISCUSSION
- F) DISCUSSION WITH PEER GROUP

2. Maximum utilization of latest form of training viz., audio visual aids, integration of IT, etc. May be adopted.

3. The total hours to be devoted against each topic may be decided with due diligence to safety & with prioritizing transfer of required skills.

4. Due weightage to be given to all the topics under the syllabus while assessing.