LABORATORY ASSISTANT (CHEMICAL PLANT)

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – CHEMICAL

GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

LABORATORY ASSISTANT (CHEMICAL PLANT)

(Revised in 2018)

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NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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CONTENTS

1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate(ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

1.2 Changes in Industrial Scenario

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

1.3 Reformation

The Apprentices Act, 1961 has been amended and brought into effect from 22nd December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

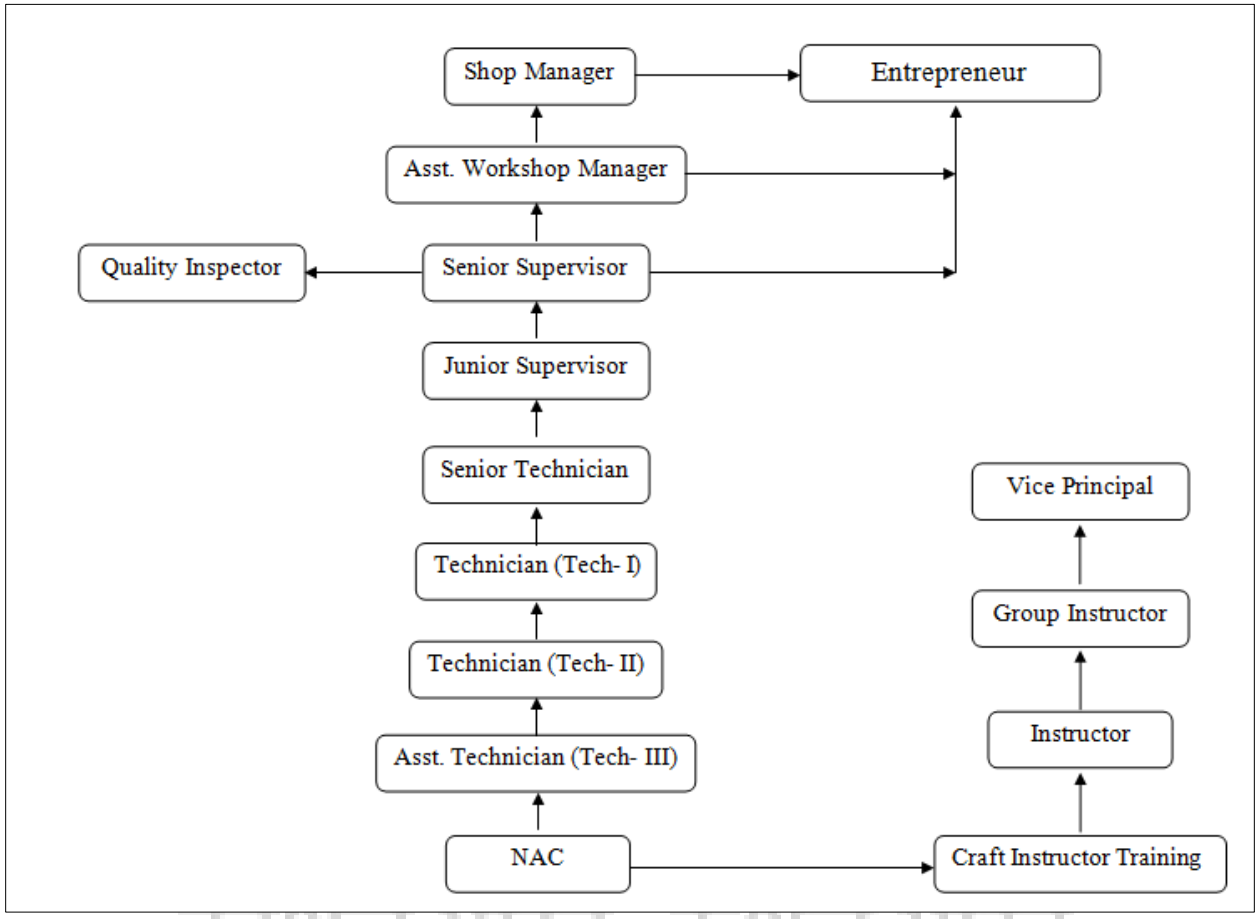
Laboratory Assistant (Chemical Plant) trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

2.2 CAREER PROGRESSION PATHWAYS:

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*) : -

Total training duration details: -

Time (in months)	1-3	4-12	13-15	16-24
Basic Training	**Block– I**	-----	**Block – II**	------
Practical Training (On - job training)	----	**Block – I**	------	**Block – II**

A. Basic Training

For 02 yrs. Engg. Course :-(**Total 06 months:** 03 months in 1st yr. + 03 months in 2nd yr.)

For 01 yr. Engg. course :-(**Total 03 months:** 03 months in 1st yr.)

Sl. No.	Course Element	Total Notional Training Hours	
		For 02 yrs. course	**For 01 yr. course**
1	Professional Skill (Trade Practical)	550	275
2	Professional Knowledge (Trade Theory)	240	120
3	Workshop Calculation & Science	40	20
4	Engineering Drawing	60	30
5	Employability Skills	110	55
	Total (including Internal Assessment)	**1000**	**500**

B. On-Job Training:-

For 02 yrs. Engg. Course :- (**Total 18 months:** 09 months in 1st yr. + 09 months in 2nd yr.)

Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. Engg. course :-(**Total 12 months**)

Notional Training Hours for On-Job Training: 2080 Hrs.

C. Total training hours:-

Duration	Basic Training	On-Job Training	Total
For 02 Engg. yrs. course	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. Engg. course	500 hrs.	2080 hrs.	2580 hrs.

2.4.1 PASS REGULATION

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b) Weightage in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy

work which demonstrates attainment of a reasonable standard of craftsmanship.	achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Weightage in the range of above 90% to be allotted during assessment	
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 produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

Laboratory Assistant, Chemical Laboratory

Laboratory Assistant, Chemical Laboratory arranges and sets various chemicals, instruments and apparatus such as salts, acids, balances, heaters as desired by Chemists for conducting experiments in chemical laboratory. Sets up required apparatus and equipment as directed by Chemist. Performs routine tasks, such as preparations of standard solutions and common reagents, weighing and measuring of salts and chemicals, filtration, precipitation etc. and conducts simple tests as directed by Chemist. Cleans and maintains balances. Maintains laboratory clean and tidy, Keeps required chemicals readily available and replenishes stock from stores. May clean special apparatus, if required.

Laboratory Assistant, Glass and Ceramics

Laboratory Assistant, Glass and Ceramics conducts routine tests of silica, clay and other ingredients in laboratories for manufacturing glass and ceramic products. Sets up apparatus required for performing test to determine properties of clay, silica, etc. Prepares solution and reagents. Maintains charts and tables for data observed during experimentation. May undertake tests in laboratory independently.

Laboratory Assistant, Chemical Engineering General

Laboratory Assistant, Chemical Engineering, General conducts chemical and physical laboratory tests and makes qualitative and quantitative analysis of material for purposes such as development of new products, materials, and processing methods and for maintenance of health and safety standards, working under Biochemists; Chemists, Analytical; Chemists, Inorganic; Chemists, Organic; or Chemists, Physical. Sets up laboratory equipment and instruments, such as ovens, leaching drums, gas cylinders, kilns vacuum chambers autoclaves, pyrometers and gas analyser. Analyses products, such as drugs, plastics, dyes and paints to determine strength, purity and other characteristics of chemical contents. Tests ores, minerals, gases and other materials for presence and percentage of elements and substance, such as Carbon, Tungsten, nitrogen, iron, gold or nickel. Prepares chemical solutions for use in processing materials, such as textile, detergents, paper, felt etc., following standard formulas.

Laboratory Assistant, Petroleum and Lubricants

Laboratory Assistant, Petroleum and Lubricants; Crude Tester; Oil Tester; Gas Analyst (Petroleum refining) tests and analyses samples of crude oil and petroleum products during processing stages, using laboratory apparatus and testing equipment and following standard test procedures to determine physical and chemical properties and ensures prescribed standards of products manufactured. Tests samples of crude and blended oils, gases, asphalts,

and pressure distillates to determine characteristics, such as boiling, vapor, freeze, condensation, flash and aniline points, viscosity, specific gravity, penetration, doctor solution, distillation and corrosion, using test and laboratory equipment, such as hydrometers, fractionators, factional distillation apparatus and analytical scales. Analyses contents of products to determine presence of gases, such as propane, isobutane, butane, isopentane, and ethane using appropriate distillation columns. Determines hydro carbon composition of gasolines, blending stocks, and gases using fractional distillation equipment and mass spectrometer. Operates fractional columns to separate crude oil into oils with different boiling points to determine their properties. Analyses composition of products to determine quantitative presence of gum, Sulphur, aromatics olefins, water and sediment. Compares colour of liquid product with charts to determine processing factors measurable by colour. Compares tests results with specifications and recommends processing changes to improve and control quality of products. May test sub-surface cores during drilling operations.

Laboratory Assistant, Metallurgical

Laboratory Assistant, Metallurgical conducts routine tests of metals and alloys to determine their physical and chemical properties. Collects metallic wastes, metal samples or ores to be examined. Sets up scientific equipment required for testing. Assist Metallurgist in testing and analyzing different types of metals, their by-products, waste and alloys. May conduct examination of metals on his initiative independently.

Chemist, Analytical

Chemist, Analytical conducts chemical analysis of inorganic and organic samples to ascertain their composition, reaction and properties. Performs basic tasks like Chemist General using instruments, apparatus and standard reagents in the laboratory such as spectroscope, pressure and temperature recording devices, desiccators, balances, acids, alkalize, and standard solution indicators to determine composition, strength or conformity with prescribed standards to ascertain presence or absence of a particular element. Analyses findings and submits report to medical or other authorities. May do statistical interpretation of observations.

Reference NCO-2015

(i) 3111.0300 – Laboratory Assistant, Chemical Laboratory
(ii) 3116.0100 – Laboratory Assistant, Glass and Ceramics
(iii) 3116.0300 – Laboratory Assistant, Chemical Engineering General
(iv) 3116.0500 – Laboratory Assistant, Petroleum and Lubricants
(v) 3117.0300 – Laboratory Assistant, Metallurgical
(vi) 2113.0500 – Chemist, Analytical

4. NSQF LEVEL COMPLIANCE

NSQF level for Laboratory Assistant (Chemical Plant) trade under ATS: **Level 5**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. professional knowledge,
c. professional skill,
d. core skill and
e. Responsibility.

The Broad Learning outcome of Laboratory Assistant (Chemical Plant) trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 5	Job that requires well developed skill, with clear choice of procedures in familiar context.	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information.	Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication.	Responsibility for own work and Learning and some responsibility for other's works and learning.

5. GENERAL INFORMATION

Name of the Trade	LABORATARY ASSISTANT (CHEMICAL PLANT)
NCO - 2015	3111.0300, 3116.0100, 3116.0300, 3116.0500, 3117.0300, 2113.0500
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block–I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10th Class with Science and Mathematics under 10+2 system of Education or its equivalent
Selection of Apprenticeship	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI / Bsc. (PCM) Trainees	01 year
CTS trades eligible for Laboratory Assistant (Chemical Plant) Apprenticeship	Laboratory Assistant (Chemical Plant)

Note:

- *Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.*
- *For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.*

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Laboratory Assistant (Chemical Plant) course of 02 years duration under ATS.

Block I & II:-

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, speed and velocity Pressure, flow of fluids, viscosity, Reynolds number,]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, freehand sketches of valves , free hand flow sheets of manufacturing of Sulphuric acid, nitric acid, urea, Ammonia, ethanol, free hand sketches of distillation column, size reduction equipments, pressure, level, flow ,temperature control system.]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. Identify common chemical reagents and prepare various types of solutions.
2. Plan and estimate the strength of unknown acid, bases and other reagents.

3. Execute precipitation and complex metric titration to determine the strength of unknown reagents and record the data.
4. Verify the physical/ thermal properties and record the analysis.
5. Identify and test various electrical components like switches, fuses, conductors etc.
6. Identify, test various electronic components using proper measuring.
7. Verify the Electro-chemical properties of electrolytes.
8. Execute quantitative analysis of metal and non-metal by Gravimetric estimations.
9. Perform detection of inorganic substances by qualitative analysis.
10. Assemble, Test, calibrate the pressure, temperature and recording instrument.

Block – II

11. Plan and organize the technique (with different unit process and unit operation) of organic compounds.
12. Plan and organize technique of inorganic substance with quality control.
13. Analyze different organic compounds to identify the compound and determine various parameters.
14. Analysis of different organic compounds and measurement in respect of waste water management.
15. Perform quantitative analysis of ore, alloy, organic and inorganic substance.
16. Perform analysis of fuel gas, sugar, oil, fat, soap and nitrogen in fertilizer.
17. Operate various measuring instruments used in chemical plant and laboratory.
18. Perform proximate analysis of coal and calorific value of different fuels.
19. Perform detection of micro-organism in food, pharmaceutical and other related laboratories.
20. Perform Experiments on Analyzing Equipment

Note: *Learning outcomes are reflection of total competencies of a trainee and assessment will be carried out as per assessment criteria.*

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1. 2. Recognize and report all unsafe situations according to site policy.
	1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1. 5. Identify and observe site policies and procedures in regard to illness or accident.
	1. 6. Identify safety alarms accurately.
	1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1. 8. Identify and observe site evacuation procedures according to site policy.
	1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1. 10. Identify basic first aid and use them under different circumstances.
	1. 11. Identify different fire extinguisher and use the same as per requirement.
	1. 12. Identify environmental pollution & contribute to avoidance of same.
	1. 13. Take opportunities to use energy and materials in an environmentally friendly manner
	1. 14. Avoid waste and dispose waste as per procedure
	1. 15. Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the field of study including basic	Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

electrical and apply in day to day work*[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, flow of fluid, Pressure, Viscosity, Reynolds's number]*	2.1 Measure dimensions as per drawing
	2.2 Measure dimensions as per drawing
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthling.
	2.8 Different types of flow, viscosity, Reynolds's number
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views,]*	3. 1. Read & interpret the information on drawings and apply in executing practical work.
	3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
	3. 4. Symbolic representation of valves, free hand sketches of size reduction equipments, distillation column, flow sheets of .Sulphuric acid, Nitric acid, .Ammonia, Urea, Ethanol, etc.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.
	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Chemical sample analysis	5.1 Acid-base titration, distillation, BP, MP,P^H measurement. Sample analysis
6. Explain energy conservation, global warming and pollution and contribute in day to day work by	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.

optimally using available resources.	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7. 1. Explain personnel finance and entrepreneurship.
	7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8. 1. Use documents, drawings and recognize hazards in the work site.
	8. 2. Plan workplace/ assembly location with due consideration to operational stipulation
	8. 3. Communicate effectively with others and plan project tasks
	8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
Block-I & II	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II**(section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	Induction Training. Operation of fire extinguisher. Use of personal protective equipments. Introduction to Material Safety Data Sheet (MSDS) and personal protection equipments (PPEs) used in chemical plant.	**General Safety:** Introduction & importance of safety &. General precautions observed in the laboratory. Fire prevention and fire control in chemical industries. Study of personal protection equipments (PPEs) used in chemical plant. First aid in chemical plant. Introduction to occupational health hazard. Environmental pollution, sources, causes, consequences and controls. Induction Training. Fire & Safety in Chemical Lab/Plant. First Aid. Introduction of pollution control.
2	Preparation of solutions of solids, liquids, volatile, non-volatile, etc. substances. Preparation of standard & primary standard solutions.	**General & Physical Chemistry** Introduction to chemistry. Elements, atoms, molecules and compound. Chemical & physical changes.
3	Volumetric Analysis (Acidimetric Titrations) Analysis of acids & bases.	Atomic Weight, Molecular Weight, Equivalent Weight. Study of Gas Laws and Gas equation.
4	Oxidation-Reduction titration. Permanganometry-titration using permanganate solution.	Structure of Atom. To study of Periodic table.
5	Iodo and idometry titrations using iodine solution directly or indirectly.	Electronic Theory of Valence. Chemical Equilibrium
6	Precipitation titration. Complexo metric titrations.	Air and water Fertilizer
7-8	Gravimetric Estimation of Aluminum, Copper And Sulphate.	Metallurgy Metallurgy of: (a) Aluminum. (b) Copper
9-10	Inorganic qualitative analysis	Non-Metals: Preparation, properties & uses of following: (a) Hydrogen & its peroxide.

		(b) Oxygen
11	Physics: (a) Law of parallelogram of forces with the help of mechanical board. (b) Simple pendulum.	Simple Machines, Efforts and load, mechanical advantage, velocity ratio, efficiency of machines, the relationship. Simple Harmonic motion.
12	(c)Electric cell in series connection & parallel connections (d) To study ohm's law (e) To Study Kirchhoff's law about current and voltage	**Electricity:** Electric current , +ve and –ve terminal use of fuses and switches , conductors and insulators , simple electrical circuits , Ohms law , Kirchoff's law , Parallel and Series circuit connections.
13.	(f) Verification of faraday's first law of electrolysis.	faraday's laws of electrolysis
	Assessment/Examination 03days	

Note: - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	**Preparation of organic compounds** **Nitration** Laboratory preparation of nitro benzene And percentage yield determination. **Oxidation** Laboratory preparation of oxalic acid.	Introduction to organic chemistry. Purification of organic compound.
2	**Diazotization:** Preparation of methyl orange. **Ozazone:** Preparation of gluecosazone. **Saponification:** Preparation of Soap	Types of organic reaction Estimation of Elements Empirical Formula and Molecular formula.
3	**Preparation of inorganic compounds** Preparation of sodium carbonate and determination of % purity and % yield. Preparation of copper sulphate and determination of % purity and % yield.	Classification and nomenclature.
4 - 5	**Organic qualitative analysis.** Analysis of organic compounds to determine : a) elements present b) functional group c) melting point	Aliphatic hydro carbons. Halogen derivatives of hydro carbon Aliphatic alcohol Aldehyde and ketones
6	**Inorganic estimation** Estimation of calcium in given tablet Oil analysis Determination of acid value of an oil & or fat.	Esters Ether
7	Estimation of formaldehyde by iodometric method	Amines Aliphatic acid
8	**Instrumental analysis** Potentiometric titration Conductometric titration	Urea Aromatic hydrocarbon
9	Detrmination of optical rotation of sugar solution using polarimeter Determination % of elements by	Aromatic halogen derivatives Aromatic acid & Alcohol.

	electrolytic analyzer	
10	Determination the pH of given solution by using pH meter. Determination of viscosity of given sample using viscometer Determination of flash point of given sample	Electrolysis Electro chemistry
11	**<u>Water analysis</u>** 1.Hardness 2.chloride 3.TDS 4.Turbidity 5.Alkalinity 6. COD 7. BOD	pH & buffer solution law of mass action
12	Study of Micro scope	Study Of Staining Technique
13	**Revision**	
	Assessment / Examination 03days	

<u>Note:</u> - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Unit**: Systems of unit- CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units**.** **Material Science** : Properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and non-Ferrous metals	**Engineering Drawing**: Introduction and its importance **Drawing Instruments** : their Standard and uses - Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips. **Lines :** - Definition, types and applications in Drawing as per BIS SP:46-2003 - Classification of lines (Hidden, centre, construction, Extension, Dimension, Section) - Drawing lines of given length (Straight, curved) - Drawing of parallel lines, perpendicular line
2.	**Fractions** : Fractions, Decimal fraction, L.C.M., H.C.F. Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator. **Mass ,Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.	**Drawing of Geometrical Figures**: Definition, nomenclature and practice of - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram, polygons. - Circle and its elements. **Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case .
3.	**Ratio & Proportion** : Simple calculation on related problems.	**Practice of Lettering and Title Block** **Dimensioning practice**:

	Speed and Velocity: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.	- Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance.
4.	**Percentage:** Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa. **Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	**Drawing of Solid figures** (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions. **Free Hand sketch of hand tools and measuring tools used in**. Burette, pipette, conical flask, beakers, secreting funnels. Condenser (leibig)
5.	**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere **Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	**Free-hand sketches** of Hand Tools, Screw drivers, Pliers, Spanner, Tweezer. Free-hand sketches of Vernier Caliper, micrometer, Depth Gauge, Dial Test Indicator, Bevel protractor. **ISI symbols** of Generator, Voltmeter, Ammeter, Watt- meter. Resister, inductor, Capacitor, Transformer, AC & DC motors.etc. - Drawing of pressure control process line**.**

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Calculation:** Archimedes's principle, principle of floatation hydrometers. Centre of gravity and Equilibrium **Science:** Definition - viscosity, flash point, fire point, flash points of standard lubricating oils, octane number.	**Drawing sketches of different types of valves**, such as gate valve, globe valve, ball valve, check valve etc. **Drawing of different types locking devices** such as double nut, castle nut, pin etc. **Symbolic representation of different types of valves**- gate valve, globe valve, butterfly valve, ball valve, diaphragm valve, control valve, non-return valve, and needle valve. **Free hand sketches** of Belt conveyor, Screw conveyer, Distillation Column
2.	**Calculation:** Pressure, temperature, Boyle's law, Charles's law, Equation of perfect gas. Calculations. **Science:** Newton's laws of motion unit of force, find out resultant force parallelogram law of forces,	**Drawing of pressure, Level , flow and temperature control system.** **Free hand sketches** of crushers, ball mill, hammer mill and centrifuges
3.	**Calculation** : Centre of Gravity, (C.G. Of square, rectangle, triangle, circle, semicircle, cone) & its calculations S**cience:** Condition of equilibrium, kind of equilibrium, some examples of equilibrium in daily life.	**Free hand sketches** of steam jet ejector, steam traps**.** **Diagram of distillation column** with all accessories Free hand sketches of process instrument- such as temperature indicator, level indicator, LIC, TIC, PI, PIC, FI, FIC**.**
4.	**Flow of fluids-** Equation of continuity, Bernoulli's theorem. **Science**: Advantages & Disadvantages of friction, Limiting friction, Laws of limiting friction, Coefficient of friction, angle of friction, Inclined plane, Force of friction	**Flow sheet / Block diagram of** 1.Nitric acid 2.Ammonia 3. Urea
5.	Flow measurement by orifice meter, venturi meter, Rota meter, U-tube manometer. Latent heat, sensible heat, saturated steam, wet steam, superheated steam. Reynolds's number, at different velocities.	**Projections:** - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification Drawing of Orthographic projection

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

Block – I **(Duration – 55 hrs.)**	
1. English Literacy	Duration : 20 Hrs. Marks : 09
Pronunciation	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
Functional Grammar	Transformation of sentences, Voice change, Change of tense, Spellings.
Reading	Reading and understanding simple sentences about self, work and environment
Writing	Construction of simple sentences Writing simple English
Speaking / Spoken English	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy	Duration : 20 Hrs. Marks : 09
Basics of Computer	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
Computer Operating System	Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.
Word processing and Worksheet	Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.
Computer Networking and Internet	Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet,

	Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes.
3. Communication Skills	Duration : 15 Hrs. Marks : 07
Introduction to Communication Skills	Communication and its importance Principles of Effective communication Types of communication - verbal, non verbal, written, email, talking on phone. Non verbal communication -characteristics, components-Para-language Body language Barriers to communication and dealing with barriers. Handling nervousness/ discomfort.
Listening Skills	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening. Triple- A Listening - Attitude, Attention & Adjustment. Active Listening Skills.
Motivational Training	Characteristics Essential to Achieving Success. The Power of Positive Attitude. Self awareness Importance of Commitment Ethics and Values Ways to Motivate Oneself Personal Goal setting and Employability Planning.
Facing Interviews	Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview.
Behavioral Skills	Problem Solving Confidence Building Attitude
Block – II **Duration – 55 hrs.**	
4. Entrepreneurship Skills	Duration : 15 Hrs. Marks : 06
Concept of	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation.

Entrepreneurship	Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
Project Preparation & Marketing analysis	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
Institutions Support	Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
Investment Procurement	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
5. Productivity	Duration : 10 Hrs. Marks : 05
Benefits	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.
Comparison with developed countries	Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.
Personal Finance Management	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
6. Occupational Safety, Health and Environment Education	Duration : 15 Hrs. Marks : 06
Safety & Health	Introduction to Occupational Safety and Health importance of safety and health at workplace.
Occupational Hazards	Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
Accident & safety	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.

First Aid	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.
Basic Provisions	Idea of basic provision legislation of India. safety, health, welfare under legislative of India.
Ecosystem	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
Pollution	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
Energy Conservation	Conservation of Energy, re-use and recycle.
Global warming	Global warming, climate change and Ozone layer depletion.
Ground Water	Hydrological cycle, ground and surface water, Conservation and Harvesting of water.
Environment	Right attitude towards environment, Maintenance of in -house environment.
7. Labour Welfare Legislation	Duration : 05 Hrs. Marks : 03
Welfare Acts	Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.
8. Quality Tools	Duration : 10 Hrs. Marks : 05
Quality Consciousness	Meaning of quality, Quality characteristic.
Quality Circles	Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles.
Quality Management System	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
House Keeping	Purpose of House-keeping, Practice of good Housekeeping.
Quality Tools	Basic quality tools with a few examples.

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

Block – I

1. ORIENTATION:-

1.1 Aware with Plant – its raw materials, products, capacity of production etc.

1.2 Study of the process with the help of a simple flow sheet under the guidance of the plant in-charge / supervisors found of the plant.

1.3 Writing report (diary) of day to day work.

1.4 Familiarization with various types of testing and analysis etc.

2. SAFTEY:-

2.1 Cause and prevention of accidents.

2.2 Personnel safety and use of personnel protective equipments.

2.3 House Keeping.

2.4 Fire prevention and fire fighting.

2.5 Carefully Handling of hazardous chemicals.

2.6 Carefully Handling of Glassware

The following analysis be carried for raw materials, intermediate products and finished products etc. according to the facilities available in the industries.

3. **QUALITATIVE ANALYSIS :-**

3.1 Detection of the important positive and negative radicals qualitatively.

4. **VOLUMETRIC ANALYSIS :-**

4.1 Preparation of standard solutions

4.2 Acidimetric and Alkalimetry titrations.

4.3 Oxidation and reduction titrations.

4.4 Precipitation titrations.

4.5 Complexometric titrations.

5 **GRAVIMETRIC ANALYSIS:-**

5.1 Estimation of aluminum, iron, barium, nickel, zinc etc. in a compound.

Block – II

6. **QUALITATIVE DETERMINATION (ORGANIC)**

6.1 Detection of functional groups.

7. **ORGANIC ESTIMATIONS:-**
   - 7.1 Estimation of sugar, acids, nitro groups and amino groups.
   - 7.2 Fractional, azeotropic, molecular, and vacuum distillation of liquid mixture.
8. **INORGANIC AND ORGANIC PREPARTIONS:-**
   - 8.1 Preparation of inorganic substance
   - 8.2 Purification of Compound by distillation.
9. **INSRUMENTLE ANALYSIS:-**

Handling and analysis with the help of the following instruments.

- 9.1 Refractometer
- 9.2 Polarimeter.
- 9.3 Orsat apparatus.
- 9.4 UV-VIS Spectrophotometer.
- 9.5 Polarograph
- 9.6 Gas Chromatograph
- 9.7 Flame Photometer
- 9.8 Electrophoresis.
- 9.9 Digital Viscometer
- 9.10 Elemental Analyzer.
- 9.11 High Performance Liquid Chromatography.
- 9.12 Bomb calorimeters
- 9.13 Karl-fisher Apparatus.

Note:

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.

2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

ELECTROPLATER			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. LIST OF CONSUMABLES			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1.	Erlenmeyer flasks.	250 ml Borosilicate Glass	36 nos.
2.	Erlenmeyer flasks.	100 ml Borosilicate Glass	24 nos.
3.	Burettes with Teflon stop cock -	25 ml. Borosilicate Glass	16 nos.
4.	Burettes with Teflon stop cock -.	50 ml Borosilicate Glass	16 nos.
5.	Pipettes	10 ml. Borosilicate Glass (Volumetric Type)	36 nos.
6.	Pipettes	25 ml. Borosilicate Glass (Volumetric Type)	36 nos.
7.	Pipettes measuring	0 to 5 ml. Borosilicate Glass	24 nos.
8.	Pipettes measuring	0 to 10 ml. Borosilicate Glass	24 nos.
9.	Pipettes measuring	0 to 1 ml. Borosilicate Glass	6 nos.
10.	Pipettes	1ml. (graduated) Borosilicate Glass	12 nos.
11.	Measuring cylinders	25 ml. Borosilicate Glass	10 nos.
12.	Measuring cylinders	50 ml. Borosilicate Glass	24 nos.
13.	Volumetric flask	100 ml. Borosilicate Glass	24 nos.
14.	Volumetric flask	250 ml. Borosilicate Glass	24 nos.
15.	Volumetric flask	500 ml. Borosilicate Glass	24 nos.
16.	Volumetric flask	1000 ml. Borosilicate Glass	12 nos.
17.	Weighing bottles polyethylene or glass 50 ml.		24 nos.
18.	Weighing bottles polyethylene or glass 100 ml.		12 nos.
19.	Funnels with regular & long stem	7 cm. dia.	24 nos.
20.	Funnels	4 cm. dia. Borosilicate Glass	24 nos.
21.	Funnels Buchner	different sizes 10 to 25 cm. dia.	6 nos.
22.	Funnels separatory	250 ml. Borosilicate Glass	12 nos.
23.	Beakers	100 ml. Borosilicate Glass	48 nos.
24.	Beakers	250 ml. Borosilicate Glass	48 nos.
25.	Beakers	400 ml. Corning	48 nos.
26.	Beakers	600 ml. Borosilicate Glass	24 nos.

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27.	Watch glasses	5 cm. dia.	24 nos.
28.	Watch glasses	7.5 cm.dia.	48 nos.
29.	Dishes evaporating	7.5 cm. dia.	24 nos.
30.	Thermometers	0 to 110°C	24 nos.
31.	Thermometers	0 to 250°C	12 nos.
32.	Thermometers	0 to 350°C	12 nos.
33.	Thermometers for drying oven		3 nos.
34.	Boiling flasks with round bottom	250ml.	16 nos.
35.	Boiling flasks with round bottom	500ml. for each distilling flasks 50 ml., 100 ml., 250 ml.	16 nos.
36.	Filtering flasks	250 ml.	24 nos.
37.	Filtering flasks	500 ml.	24 nos.
38.	Condensers Liebig	30 mm. long Borosilicate Glass	24 nos.
39.	Gas generator (Kips)	500 ml.	5 nos.
40.	Gas washing bottles (Dressler)		24 nos.
41.	Crucibles porcelain	5 cm, dia, height 4 cm indigenous	60 nos.
42.	Test tube	160 mm x 15 mm.	500 nos.
43.	Tubes for centrifuge		500 nos.
44.	Bottles with droppers for indicator solutions & semi-micro qualitative analysis	30 ml.	16 nos.
45.	Bottles for solids	50 ml. Borosilicate Glass	24 nos.
46.	Bottles for solids	100 ml. Borosilicate Glass	24 nos.
47.	Bottles for solutions	100 ml. Borosilicate Glass	24 nos.
48.	Bottles for solutions	250 ml. Borosilicate Glass	24 nos.
49.	Bottles for solutions	1000 ml. Borosilicate Glass	12 nos.
50.	Bottles for solutions	2000 ml. Borosilicate Glass	12 nos.
51.	LCD Multimedia projector		1 no.
52.	Computer/Laptop (latest configuration) with licentiate operating software.		1 no.
53.	Printer (Printer, Scanner & Copier) with one extra cartridge		1 no.
54.	Desiccators vacuum	150mm Diameter Borosilicate Glass	4 no
55.	Tongs (forceps) nickel for crucibles & weights	size 8 inches	16 no
56.	Tongs long for crucibles (muffle furnace)	size 15 inches	4 no
57.	Spatulas nickel	8”	16 no
58.	Test tube support for 10-12 test tubes		16 no
59.	Tripods		16 no
60.	Asbestos wire gauage		36 no

61.	Test tube holders		16 no
62.	Burette stand with clamp & clamp holders		20 no
63.	Triangles clay		36 no
64.	Glass rods		5 kg
65.	Petri Disc		6 no.
66.	Slide for Microscope		20 no.
TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS			
67.	Analytical balances of different makes	200 gram 0.001 mg	1 No
68.	Digital Balance	capacity 1KG, accuracy 1mg	1 No
69.	Various types of Viscometer (Redwood, Oswald, Tar)		1 No
70.	Shaking machine (Bottle, Flask etc)		1 No
71.	Mechanical board for testing triangle and parallelogram of forces including all accessories.		2 Set
72.	Instrument for determining 'g' (simple pendulum).with stand		2 Set
73.	Thermometers:	(a) 0 to 110* C (b) 0 to 250* C (c) 0 to 360* C	12 no 12 no 12 no
74.	Polarimeter Digital		1 set
75.	Abbe refractometer. Digital		1 no
76.	Equipment to study Kirchoff's Law and electro chemical equivalent.		1 set
77.	Resistance Box	50 ohms, 100 ohms	2 no
78.	(a) Rheostat 25 Ohms (b) Rheostat 100 Ohms		1 no each
79.	Ammeters with stands:	(a) 0 to 1 Amp (DC) (b) 0 to 3 Amp (DC)	2 sets 2 sets
80.	Voltmeter with stands:	(a) 0 to 1 Volt (DC) (b) 0 to 5 Volt (DC) (c) 0 to 10 Volt (DC)	2 sets 2 sets 2 sets
81.	Mill voltmeter :	(a) 0 to 5 mV (b) 0 to 500 mV	2 sets 2 sets
82.	Digital Multi meter		1 no
83.	DC Power supply	12 V, 2 A	2 no
84.	Water baths (6 places)(Electrically heated)		1 no
85.	Sand bath		1 no
86.	pH meter Digital		1 no

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87.	Auto titrator		1 no
88.	Conductivity meter		1 no
89.	Magnetic stirrers (with heating plate)	2 liters capacity	2 no
90.	Mortar,	100mm, porcelain with pestle	2 no
91.	Heating plates (Electrical)	1000 watt	2 no
92.	Melting point apparatus		1 no
93.	Apparatus for determination of flash point		1 no
94.	Bunsen's burners		16 no
95.	Steam generator (copper) for steam distillation	2 ltr cap	4 no
96.	Distilled water plant	4 ltr /Hr	1 no
97.	TDS Meter digital		1
98.	Heating Mental	1,2 & 5 ltr	1 set
99.	COD Apparatus		1
100.	BOD Apparatus		1
101.	Incubator		1
102.	Microscope		1

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: LABORATARY ASSISTANT (CHEMICAL PLANT)

LIST OF TOOLS & EQUIPMENTS FOR -20APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box		20+1 set
2.	Set square celluloid 45^o	(250 X 1.5 mm)	20+1 set
3.	Set square celluloid 30^o-60^o	(250 X 1.5 mm)	20+1 set
4.	Mini drafter		20+1 set
5.	Drawing board IS: 1444	(700mm x500 mm)	20+1 set
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		20
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01
6	White Board	(size: 8ft. x 4ft.)	01
7	Trainer's Table		01
8	Trainer's Chair		01

TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS		
Sl. No.	**Name of the Equipment**	**Quantity**
1.	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 Nos.
2.	UPS - 500VA	10 Nos.
3.	Scanner cum Printer	1 No.
4.	Computer Tables	10 Nos.
5.	Computer Chairs	20 Nos.
6.	LCD Projector	1 No.
7.	White Board 1200mm x 900mm	1 No.
Note: - Above Tools & Equipments not required, if Computer LAB is available in the institute.		

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

Name & Address of the Assessor :			**Year of Enrollment :**
Name & Address of ITI (Govt./Pvt.) :			**Date of Assessment :**
Name & Address of the Industry :			**Assessment location: Industry / ITI**
Trade Name :	**Semester:**		**Duration of the Trade/course:**
Learning Outcome:			

Sl. No	**Candidate Name**	**Father's/Mother's Name**	Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA	**Total internal assessment Marks**	**Result (Y/N)**
Maximum Marks (Total 100 Marks)			**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**		
1														
2														