CHEMICAL LABORATORY ASSISTANT

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – CHEMICAL SECTOR

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

CHEMICAL LABORATORY ASSISTANT

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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Co-ordinator for the course: Shri Sunil Wakde , ADT, Advanced Training Institute,, Mumbai

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Chemical Laboratory Assistant

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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.

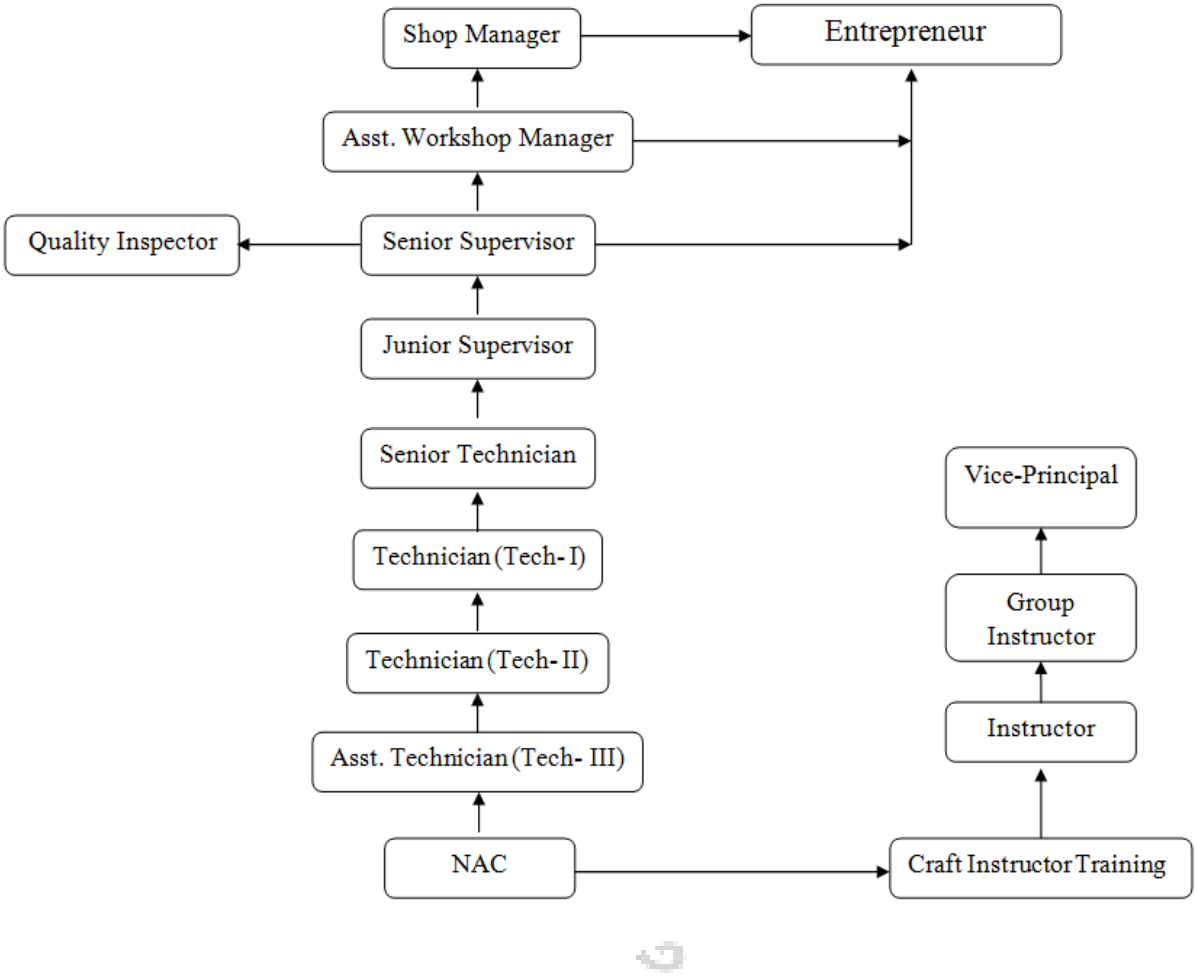
Chemical Laboratory Assistant trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills 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/finishing and 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**

Chemical Laboratory Assistant

A. Basic Training

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

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

S 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. 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. 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 yrs. Course (Engg.)	1000 hrs.	3120 hrs.	4120 hrs.
For 01 yr. Course (Engg.)	500 hrs.	2080 hrs.	2580 hrs.

2.4 ASSESSMENT & CERTIFICATION:

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training

institute have to maintain individual *trainee portfolio* as detailed in assessment guideline (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.

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	• Demonstration of good skill in the use of

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.	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 work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy 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:

1. **Chemical Laboratory Assistant,** 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.

2. **Chemical 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.

3. **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.

4. **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 analyzer. 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.

5. **Chemical 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, vapour, 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 analystical scales. Analyses contents of products to determine presence of gases, such as propane, iso-butane, butane, isopentane, and ethane using appropriate distillation columns. Determines hydro carbon composition of gasolines, blending stocks, and gases using fractional distillation equipment and mass sperctrometer. Operates fractional

columns to separate crude oil into oils with different boiling points to determine their properties. Analyses composition of products to determine quantitavie presence of gum, sulfar, 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.

6. **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 analysing different types of metals, their by-products, waste and alloys. May conduct examination of metals on his initiative independently.

NCO Code 2015: 3111.0300 - Laboratory Assistant, Chemical

4. NSQF LEVEL COMPLIANCE

NSQF level for Chemical Laboratory Assistant 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 Chemical Laboratory Assistant 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, communicatio n.	Responsibility for own work and Learning and some responsibility for other's works and learning.

5. GENERAL INFORMATION

Name of the Trade	Chemical Laboratory Assistant
NCO-2015	3111.30
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 examination under 10+2 system of education with physics, chemistry and mathematics or its equivalent
Selection of Apprentices	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.
Infrastructure for Basic Training	As per related trades of ITI
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 Trainees	01 year
CTS trades eligible for Chemical Laboratory Assistant Apprenticeship	1. Chemical Laboratory Assistant

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

6.1GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Chemical Laboratory Assistant 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, Power transmission, Pressure]*
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, Sectional views, Estimation of material, Electrical & electronic symbol]*
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. **ORIENTATION**:-

- Knowledge about the Plant – its raw materials, products, capacity of production etc.
- Knowledge of the process with the help of a simple flow sheet under the guidance of the plant in-charge / supervisors in the plant.
- Write the report (diary) of day to day work.
- Familiar with various types of testing and analysis equipments etc.

2. **SAFTEY :-**

- Knowledge about the Cause and prevention of accidents.
- Knowledge about the Personnel safety and use of personnel protective equipments.
- Plan and maintain the House Keeping.
- Operate fire fighting extinguisher and knowledge of the Fire prevention.
- Handle the hazardous chemicals
- Handle the Glassware very carefully.
- Explain the Behaviour Based Safety (BBS)

3. Prepare solution and operate weighing balance for sampling to prepare different types of solution as per the Equivalent weight, Molecular weight, Atomic weight, Specific gravity, Normality, Acidity, Basicity, Concentration, Normal Solution and Molar Solutions.
   Prepare the acid solutions, basic solutions and oxidizing - reducing agent, solutions.
   Prepare solutions of different concentration and determine the concentration and percentage purity.
4. Prepare the Complexometry solutions, indicators, sampling in solids, liquids and gases.
   Standardize the solutions
   Prepare the Ethylene diamine tetra acetic acid (EDTA) solution & indicator and titration with EDTA.
5. **Metallurgical analysis**
   Atomic Absorption Spectrophotometry
   Analysis of the different sample (such as Cu, Fe, Mn. etc.) on Atomic Absorption Spectrophotometer
6. **X-ray crystallography**:
   Determine the different size of crystal samples.
7. **Flame Photometry**:
   Determine the Sodium (Na), Potassium (K), Calcium (Ca) in different industrial samples by Flame photometer.
8. Check the sample with Electron Microscope.
   Perform the Ore analysis, carbon analysis, analysis of Pyrolusite for determining the percentage of manganese (Mn).
9. Perform the metallurgical analysis in cements industries by using the different volumetric and gravimetric analytical methods.
10. Perform analysis in Foundry.
11. Perform analysis of Different alloys, brass, solder wire etc.
12. **Gas Chromatography (GC):**
    Perform the separation of different sample mixture (Industrial products) on gas chromatography.
    Identify and determine quantity of the each separated components.
13. **High Performance Liquid Chromatography (HPLC):**

Perform the separation of different sample mixture (Industrial products) on High Performance Liquid Chromatography (HPLC).

Identify and determine quantity of the each separated components

Block – II

14. **Thin Layer Chromatography (TLC):**
    Perform the separation of different sample mixture on thin layer chromatography.
15. **Gas Chromatography Mass Spectrometry (GC / MS) :**
    Identify the different sample by using GC/ MS
16. **UV – Vis Spectroscopy :**
    Determine the percentage composition of different sample components.
17. **Fourier Transform Infrared Spectrophotometer (IR/FTIR Spectrophotometer):**
    Perform analysis of different samples (Industrial products)
    i) Calibration by polystyrene film
    ii) Study of background spectra
    iii) Study of different solid samples & analysis of spectrum obtained
18. Explain Water, sources of water and different water treatment processes, de-mineralized (DM) water, Industrial water, potable water.
    Perform the different sampling techniques used for different water available in industry. Perform analysis of each water sample for parameters such as P^H, alkalinity, Total Dissolved Solids (TDS), conductivity, total, temporary & permanent hardness of any water sample. Etc.
19. Explain chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), and Dissolved Oxygen (D.O).
    Determine the COD, BOD, DO for different water sample /effluent.
20. Determine the mixed liquor suspended solids (MLSS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), P^H, Turbidity of given water sample.
    Perform analysis for Some Minute Minerals like Magnesium (Mg), Potassium (K), Sodium (Na), Arsenic (As), etc in Hard water and Soft water
21. Detect the acid value, iodine value, saponification value , flash point, pour point, cloud point, Viscosity, refractive index, optical rotation, specific rotation of oils, fats and petroleum products etc. of different Industrial samples.
22. Detect the elements, functional group, Melting point, Boiling point, Technique of purification.
    Perform preparation of Compound derivatives.
23. Prepare the organic compounds such as Acetanilide, Aspirin, Phenolphthalein, soap, Glucosazone etc.
24. Perform collection of sample and then analyse the Microbiological Culture analysis.
25. Detect and prepare the inoculate media.

Explain the Techniques of inoculation & staining.

26. Operate and Handle the equipments used in microbiological lab such as Centrifuge, pH-Meter, incubator and Shaker.
27. Explain the Sterilization, fermentation and formulation.
    Prepare the different Solutions related to the microbiological lab.

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 electrical and	2.1 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.
	2.2 Measure dimensions as per drawing

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, Power transmission, Pressure]*	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 & earthing.
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, Sectional views, Estimation of material, Electrical & electronic symbol]*	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.
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 them with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job. 5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws. 5.3 Knows benefits guaranteed under various acts

6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	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	
<u>Block-I & II (Section:10)</u>	
*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 (275Hrs)	Professional Knowledge (120 Hrs)
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/laboratory.	**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/laboratory First Aid. Introduction of pollution control.
2.	Preparation of solutions of solids, liquids, volatile, non-volatile, etc. substances. Preparation of standard & primary standard solutions. Purification & separation of liquid mixture by distillation	**General & Physical Chemistry** Introduction to chemistry. Elements, atoms, molecules and compound. Chemical & physical changes. Methods of purification : distillation
3.	**Volumetric Analysis** (Acidimetric titrations and Alkali metric titration) Analysis of acids & bases.	Acid ,base, salt, Atomic Weight, Molecular Weight, Equivalent Weight, Normality, Molarity, Molality, ppm, ppb, density, Specific gravity, Weight - volume relationship
4.	**Oxidation-Reduction titration**. Permanganometry-titration using permanganate solution.	Structure of Atom. To study of Periodic table. Study IUPAC nomenclature.

5.	Iodometric and idometric 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** To study Action of pure and salt water on metals and alloys To study action of acids and base on metals alloys	Extraction of Metal & Non-Metal **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 (MA), Velocity Ratio (VR), efficiency of machines, the relationship. Simple Harmonic motion.
12.	(a) Electric cell in series connection & parallel connections (b) To study ohm's law (c) To Study Kirchhoff's law about current and voltage	**Electricity:** Electric current, positive and negative terminal use of fuses and switches, conductors and insulators, simple electrical circuits, Ohms law, Kirchhoff's law, Parallel and Series circuit connections.
13.	Verification of Faraday's first law of electrolysis.	Electrolysis & Faraday's laws
	Revision	
	Internal Assessment 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 (275Hrs)	Professional Knowledge(120 Hrs)
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 percentage purity and percentage yield. Preparation of copper sulphate and determination of percentage purity and percentage 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	Principles of potentiometric and conductometric titrations Aromatic hydrocarbon & Urea
9.	Determination of optical rotation of sugar solution using polarimeter Determination percentage of elements by electrolytic analyzer	Aromatic halogen derivatives Aromatic acid & Alcohol.
10.	Determine the pH of given solution by using pH meter. Determination of viscosity of given sample using viscometer Determination of flash point of given sample	pH & buffer solution Viscosity
11.	**Water analysis** 1.Hardness 2.Chloride 3.Total dissolved solid (TDS) 4. Alkalinity	Law of mass action
12.	Study of Micro scope Study Of Staining Technique	---
	Revision	
13.	**Internal Assessment 03 days**	

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.*

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**EngineeringDrawing (Duration : - 30 hrs.)**
1.	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	**Engineering Drawing:** Introduction and its importance Different types of standards used in engineering drawing. Drawing Instruments: their 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.
2.	**Material Science** : properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	Lines : Types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice.
3.	**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	**Dimensioning**- Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales**:-Types use and construction. Representative factor of scale.
4.	**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view Circle and its elements.
5.	**Ratio & Proportion** : Simple calculation on related problems.	- **Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch

	Percentage: Introduction, Simple calculation.	horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand
6.	**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. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	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. - Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration - 30 hrs.)**
1.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.
2.	**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.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.
3.	**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. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	**Free hand Sketches for simple pipe line with general fittings.**
4.	**Basic Electricity:** Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their	**Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.**

	comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthling.	
5.	**Simple machines Transmission of power:** -Transmission of power by belt, pulleys & gear drive. **Heat treatment process: -** Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering.	**Simple exercises related to trade related symbols.** **Basic electrical and electronic symbols**
6.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.	**Free hand sketch of trade related components / parts /cutting tool indicating angles.**
7.	**Concept of pressure** - **Definition**:- Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems	
8.	**Simple exercises related to trade related Test Papers. Solution of NCVT test papers.**	

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 Entrepreneurship	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue Entrepreneurship vs. management, Entrepreneurial motivation. 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-JOBTRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR CHEMICAL LABORATORY ASSISTANT TRADE:

1. ORIENTATION:-
   - Knowledge about Plant – its raw materials, products, capacity of production etc.
   - 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.
   - Writing report (diary) of day to day work.
   - Familiarization with various types of testing and analysis etc.
2. SAFTEY:-
   - Cause and prevention of accidents.
   - Personnel safety and use of personnel protective equipments.
   - House Keeping.
   - Fire prevention and fire fighting.
   - Carefully handling of hazardous chemicals.
   - Carefully Handling of Glassware
   - Behaviour based safety (BBS)
3. Record keeping and documentation

Note: The following analysis be carried for raw materials, intermediate products and finished products etc. according to the facilities available in the industries. (*Theory portion / topic, SOP is to be covered before operating each of the laboratory equipments)*

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

Block – I

1. Solution preparation and sampling balance, Equivalent weight , Molecular weight, Atomic weight, Specific gravity , Normality, Acidity, Basicity, Concentration, Normal Solution, Molar Solutions, Preparations of acid solutions, basic solutions, oxidizing - reducing agent, solutions.
   Preparation of solutions of different concentration and determination of its concentration and percentage purity.
2. Complexometry solutions**,** preparations of indicators, sampling in solids, liquids and gases, Standardizations of solutions
   Preparation of Ethylene diamine tetra acetic acid (EDTA) solution & indicator and titration with EDTA.
3. **Metallurgical analysis**

Atomic Absorption Spectrophotometry

Analysis of different sample (such as Cu, Fe, Mn. etc.) on Atomic Absorption Spectrophotometer

4. **X-ray crystallography**: determination of different size of crystal samples.
5. **Flame Photometry**:
   Determination of Sodium (Na), Potassium (K), Calcium (Ca) in different industrial samples by Flame photometer.
6. Sample testing on Electron Microscope. Ore analysis, carbon analysis, analysis of Pyrolusite for determination of percentage manganese (Mn).
7. Different volumetric and gravimetric analytical methods used in metallurgical analysis in cements
8. Analysis in Foundry
9. Analysis of Different alloys, brass, solder wire etc.
10. **Gas Chromatography (GC):**
    - **High Performance** Separation of different sample mixture (Industrial products) on gas chromatography.
    - Identification of separated components and determination of quantity of each separated components.

Liquid Chromatography (HPLC):

- Separation of different sample mixture (Industrial products).on High Performance Liquid Chromatography (HPLC).
- Identification of separated components and determination of quantity of each separated components.

Block – II

11. **Thin Layer Chromatography (TLC):**
    Separation of different sample mixture on thin layer chromatography.
12. **Gas Chromatography Mass Spectrometry (GC / MS) :**

    Identification of different sample by using GC/ MS

13. **UV – Vis Spectroscopy** :
    Determination of percentage composition of different sample components
14. **Fourier Transform Infrared Spectrophotometer (**IR/FTIR Spectrophotometer):
    Analysis of different samples (Industrial products)
    Calibration by polystyrene film
    Study of background spectra
    Study of different solid samples &analysis of spectrum obtained
15. Water, sources of water, Different water treatment processes, demineralised (DM) water ,Industrial water ,potable water.
    Perform the Different water samples available in industry and their sampling techniques.

Perform Analysis of each water sample for parameters such as P^H, alkalinity, Total Dissolved

Solids (TDS), conductivity, total, temporary & permanent hardness of any water sample etc.

16. Explain Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Dissolved Oxygen (D.O). Determination of COD, BOD, DO for different water sample /effluent.
17. Determine the mixed liquor suspended solids (MLSS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), P^H, Turbidity of given water sample.
    Perform analysis for Some Minute Minerals like Magnesium (Mg), Potassium (K), Sodium (Na), Arsenic (As), etc. Hard water, Soft water
18. Detect the acid value, iodine value, saponification value , flash point, pour point, cloud point, Viscosity, refractive index, optical rotation, specific rotation of oils, fats and petroleum products, etc. of different Industrial samples.
19. Detect the elements, functional group, Melting point, Boiling point , Technique of purification, preparation of Compound derivatives
20. Prepare the organic compounds such as Acetanilide, Aspirin, Phenolphthalein, soap, Glucosazone etc.
21. Microbiological analysis Culture, Collection, Sampling,
22. Detection, preparation of innocula, Media, Techniques of inoculation & staining
23. Operate and Handle the Handling equipments in microbiological lab. Centrifuge, pH-Meter, incubator, Shaker
24. Explain the Sterilization, fermentation, formulation. Preparation of Solutions related with microbiological lab.

Note:

- *Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.*
- *In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.*

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

CHEMICAL LABORATORY ASSISTANT		
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)		
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-18 is required additionally)		
Sl. no.	**Name of the Tool & Equipments**	**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.
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.
B : INSTRUMENTS & GENERAL SHOP OUTFIT		

67	Digital balances of different makes 200 gram 0.001 mg	
68	Digital Balance capacity 1Kg, accuracy 1gram	1 No
69	Various types of Viscometer (Redwood, Ostwald, Brooks field)	Any Two
70	Shaker (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 ^{0}C (b) 0 to 250 ^{0}C (c) 0 to 360 ^{0}C	 12 no 12 no 12 no
74	Polarimeter Digital	1 set
75	Digital refractometer	1 no
76	Equipment to study Kirchoff's Law	1 set
77	Resistance Box (50 ohms, 100 ohms)	2 no each
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
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 liter capacity	4 no
96	Distilled water plant 4 liter /Hr	1 no
97	TDS Meter digital	1
98	Heating Mental 1,2 & 5 liter	1 set
99	COD Apparatus	1
100	BOD Apparatus	1
101	Incubator	1
102	Microscope	1
103	Electro chemical equivalent	1
Note: All electrical equipment should be provided with extra 20 meter wire switches, terminals for connection.		
C : GENERAL MACHINERY INSTALLATIONS		
104	Vacuum Pump With Trolley	1 no
105	Electric Drying oven (200 ^{o}C)	1 no
106	Furnaces (Muffle oven)(1100 ^{o}C)	1 no
107	Fire Extinguisher	1 no
108	Laboratory Centrifuge (Analytical)	1 no

Note: In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: CHEMICAL LABORATORY ASSISTANT

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 (700mm x500 mm) IS: 1444		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														