CURRICULUM

FOR THE TRADE OF

CHEMICAL LABORATORY ASSISTANT

UNDER

APPRENTICESHIP TRAINING SCHEME

2017

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

CONTENTS

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Co-coordinator for the course: Shri Sunil Wakde , ADT, Advanced Training Institute,, Mumbai

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18.	Mrs. K.K. Phadnis ,Training Officer	ATI, Mumbai	Member
19.	Sri R.S. Wagh, Training Officer	ATI, Mumbai	Member

2. BACKGROUND

2.1 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.

2.2 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.

2.3 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.

3. RATIONALE

[Need for Apprenticeship in "**CHEMICAL LABORATORY ASSISTANT "** trade]

- Enhancement of training for preparing skilled man power as per need of chemical laboratories and chemical industries
- To minimize skill gap between trainee and industry
- As per industrial development now a day in India, more skilled man power is required to improve the skill technique.
- Familiarization with industrial exposure/quality control laboratory
- Up-gradation of employability ratio.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

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.

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.

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.

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.

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.

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.

Reference NCO: 3111.30

5. GENERAL INFORMATION

1. **Name of the Trade** **: CHEMICAL LABORATORY ASSISTANT**
2. **N.C.O. Code No.** : 3111.30

3. **Duration of Apprenticeship Training (Basic Training + Practical Training):** 2 Years

3.1 **For Freshers: - Duration of Basic Training**: -

a) Block –I : 3 months

b) Block – II : 3 months

Total duration of Basic Training: 6 months

Duration of Practical Training (On -job Training): -

a) Block–I: 9 months

b) Block–II : 9 months

Total duration of Practical Training: 18 months

. 3.2 **For ITI in CLA/LA (CP) Passed: - Duration of Basic Training**: -

NIL

4. **Entry Qualification:**

1. Passed 10th class examination under 10+2 system of education with physics, chemistry and mathematics or its equivalent

5. **Selection of Apprentices:** The apprentices will be selected as per Apprenticeship Act amended time to time.
6. **Rebate to ITI Passed out Trainees:** One year for the trade of CLA / LACP

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.

6. COURSE STRUCTURE

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**

Components of Training	Duration of Training in Months →																							
↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Basic Training Block - I																								
Practical Training Block - I																								
Basic Training Block - II																								
Practical Training Block - II																								

7. SYLLABUS

7.1 BASIC TRAINING

(BLOCK – I & II)

DURATION: 06 MONTHS

GENERAL INFORMATION

1) **Name of the Trade** : **CHEMICAL LABORATORY ASSISTANT**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 20
4) **Power Norms** : 6 Kw
5) **Space Norms** : 96 Sq.m.

6) **Examination** : The internal assessment will be held on completion of each Block.
7) **Instructor Qualification** :

i) Degree/Diploma in CHEMICAL Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant Field.

OR

ii) BSc. Chemistry from recognized university/Board with Two year post qualification experience respectively in the relevant Field.

8) **Tools, Equipments & Machinery required** : - As per Annexure – I

7.1.1 DETAIL SYLLABUS OF CORE SKILL

A. Block– I
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hrs)	b) Workshop Science & Calculation		Duration (in hrs)
		30	Calculation (10)	Science (10)	20
1	**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. **(2 Hrs)** **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 Hrs)**		**Unit**: Systems of unit- CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units **(2 Hrs)**	**Material Science** : Properties - Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and non-Ferrous metals **(2Hrs)**	
2	**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. **(4 Hrs)** **Lettering and Numbering** as per BIS SP46-2003:		**Fractions** : Fractions, Decimal fraction, L.C.M., H.C.F. Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice	**Mass ,Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals. **(2Hrs)**	

	- Single Stroke, Double Stroke, inclined, Upper case and Lower case **(4 Hrs)**		versa. Simple problems using Scientific Calculator. **(2Hrs**)		
3	**Practice of Lettering and Title Block** **(2 Hrs)** **Dimensioning practice**: - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. **(2 Hrs)**		**Ratio & Proportion** : Simple calculation on related problems. **(2Hrs)**	**Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. **(2Hrs)**	
4	**Drawing of Solid figures** (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions. **(4 Hrs)** **Free Hand sketch of hand tools and measuring tools used in**. Burette, pipette, conical flask, beakers, secreting funnels. Condenser (leibig) **(4 Hrs)**		**Percentage** : Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa **(2Hrs)**	**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. **(2Hrs)**	
5	**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 **(4 Hrs)** **ISI symbols** of Generator, Voltmeter, Ammeter, Watt- meter. Resister, inductor, Capacitor, Transformer, AC & DC motors.etc. Drawing of pressure control process line**(2 Hrs)**		**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. **(2 Hrs)**	**Heat & Temparature**: 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. **(2 Hrs)**	

B. Block- II
Basic Training

Topic No.	a) Engineering Drawing	Duration (in hours)	b) Workshop Science & Calculation		Duration (in hours)
			Calculation	**Science**	
1	**Drawing sketches of different types of valves**, such as gate valve, globe valve, ball valve, check valve etc. **(4 Hrs)** **Drawing of different types locking devices** such as double nut, castle nut, pin etc.**(2 Hrs)** **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. **(1 Hrs)** **Free hand sketches** of Belt conveyor, Screw conveyer, Distillation Column **(2 Hrs)**	**30**	Archimedes's principle, principle of floatation hydrometers. Centre of gravity and Equilibrium condition. **(2Hrs)**	Definition - viscosity, flash point, fire point, flash points of standard lubricating oils, octane number. **(2Hrs)**	**20**
2	**Drawing of pressure, Level , flow and temperature control system. (1 Hrs)** **Free hand sketches** of crushers, ball mill, hammer mill and centrifuges **(2 Hrs)**		Pressure, temperature, Boyle's law, Charles's law, Equation of perfect gas. Calculations.. **(2 Hrs)**	Newton's laws of motion unit of force, find out resultant force parallelogram law of forces, **(2Hrs)**	
3	**Free hand sketches** of steam jet ejector, steam trap **(1 Hrs)** **Diagram of distillation column** with all accessories Free hand sketches of process		Centre of Gravity, (C.G. Of square, rectangle, triangle, circle, semicircle, cone)	Condition of equilibrium, kind of equilibrium, some examples of equilibrium in daily	

	instrument- such as temperature indicator, level indicator, LIC, TIC, PI, PIC, FI, FIC **(4 Hrs)**		& its calculations **(2 Hrs)**	life,. **(2 Hrs)**	
4	**Flow sheet / Block diagram of** 1.Nitric acid 2.Ammonia 3. Urea **(3 Hrs)**		**Flow of fluids-** Equation of continuity, Bernoulli's theorem **(2 Hrs)**	Advantages & Disadvantages of friction, Limiting friction, Laws of limiting friction, Coefficient of friction, angle of friction, Inclined plane, Force of friction **(2 Hrs)**	
5	**<u>Projections:</u>** - 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. (**10Hrs)**		Flow measurement by orifice meter, venturi meter, Rota meter, U-tube manometer. **(2 Hrs)**	Latent heat, sensible heat, saturated steam, wet steam, superheated steam. Reynolds's number, at different velocities. **(2 Hrs)**	

7.1.2 DETAIL SYLLABUS OF PROFESSIONAL SKILLS & PROFESSIONAL KNOWLEDGE

A. Block –I (3 Months)

Basic Training

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.
	Iodometric and idometric titrations using iodine	Electronic Theory of Valence.

5.	solution directly or indirectly.	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	

B. Block –II (3 Months)
Basic Training

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	Aliphatic hydro carbons Halogen derivatives of hydro carbon Aliphatic alcohol

	b) functional group c) melting point	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.	Detrmination of optical rotation of sugar solution using polarimeter Determination percentage of elements by electrolytic analyzer	Aromatic halogen derivatives Aromatic acid & Alcohol.
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	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	---
13.	**Revision**	
	Internal Assessment 03 days	

7.1.3 EMPLOYABILITY SKILLS

GENERAL INFORMATION

1) **Name of the subject** : **EMPLOYABILITY SKILLS**

2) **Applicability** : ATS- Mandatory for fresher only

3) **Hours of Instruction** : **110 Hrs. (55 hrs. in each block)**

4) **Examination** : The examination will be held at the end of two years Training by NCVT.

5) **Instructor Qualification** :

i) MBA/BBA with two years experience or graduate in sociology/social welfare/Economics with two years experience and trained in Employability skill from DGET Institute.

And

Must have studied in English/Communication Skill and Basic Computer at 12th /diploma level

OR

ii) Existing Social Study Instructor duly trained in Employability Skill from DGET Institute.

7.1.3.1 SYLLABUS OF EMPLOYABILITY SKILLS

A. Block – I

Basic Training

Topic No.	Topic	Duration (in hours)
	English Literacy	**15**
1	**Pronunciation :** Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)	
2	**Functional Grammar** Transformation of sentences, Voice change, Change of tense, Spellings.	
3	**Reading** Reading and understanding simple sentences about self, work and environment	
4	**Writing** Construction of simple sentences Writing simple English	
5	**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.	
	I.T. Literacy	**15**
1	**Basics of Computer** Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.	
2	**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.	
3	**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	
4	**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.	
	Communication Skill	**25**
1	**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. Case study/Exercise	
2	**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.	
3	**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. Case study/Exercise	
4	**Facing Interviews** Manners, Etiquettes, Dress code for an interview Do's & Don'ts for an interview	
5	**Behavioral Skills** Organizational Behavior Problem Solving Confidence Building Attitude	

	Decision making Case study/Exercise	

B. Block– II
Basic Training

Topic No.	Topic	Duration (in hours)
	Entrepreneurship skill	**10**
1	**Concept of Entrepreneurship** **Entrepreneurship**- 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.	
2	**Project Preparation & Marketing analysis** Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of Product Life Cycle (PLC), Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.	
3	**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.	
4	**Investment Procurement** Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.	
	Productivity	**10**
1	**Productivity** Definition, Necessity, Meaning of GDP.	
2	**Affecting Factors** Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.	
3	**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.	
4	**Personal Finance Management** Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.	
	Occupational Safety, Health & Environment Education	**10**

1	**Safety & Health** Introduction to Occupational Safety and Health importance of safety and health at workplace.	
2	**Occupational Hazards** Basic Hazards, Chemical Hazards, Vibro-acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.	
3	**Accident & safety** Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.	
4	**First Aid** Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person	
5	**Basic Provisions** Idea of basic provision legislation of India. of safety, health, welfare under legislation of India.	
6	**Ecosystem** Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.	
7	**Pollution** Pollution and pollutants including liquid, gaseous, solid and hazardous waste.	
8	**Energy Conservation** Conservation of Energy, re-use and recycle.	
9	**Global warming** Global warming, climate change and Ozone layer depletion.	
10	**Ground Water** Hydrological cycle, ground and surface water, Conservation and Harvesting of water	
11	**Environment** Right attitude towards environment, Maintenance of in -house environment	
	Labour Welfare Legislation	**5**
1	**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.	
	Quality Tools	**5**
1	**Quality Consciousness :** Meaning of quality, Quality Characteristic	
2	**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.	
3	**Quality Management System :** Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.	

4	**House Keeping :** Purpose of Housekeeping, Practice of good Housekeeping.	
5	**Quality Tools** Basic quality tools with a few examples	
	Leadership and Team Building skills.	**5**
	Leadership Discipline and Morale Team Work Case Study/ Exercise	
	Meet the Mentor **Role - play as a Supervisor**	**5**
	Organizing and Planning.	**5**
	Time Management Group Dynamics Case Study/ Exercise	

7.2 PRACTICAL TRAINING (ON-JOB TRAINING)
(BLOCK – I & II)
DURATION: 18 MONTHS (9 months in each block)

GENERAL INFORMATION

1) **Name of the Trade** : **CHEMICAL LABORATORY ASSISTANT**

2) **Batch size** : a) Apprentice selection as per Apprenticeship Guidelines

b) Maximum 20Candidates in a group

3) **Examination** : i) The internal assessment will be held on completion of each block

ii) NCVT exam will be conducted at the end of 2nd year.

4) **Instructor Qualification** :

i) Degree/Diploma in CHEMICAL Engg. from recognized university/Board with one/two year post qualification experience respectively in the relevant Field.

OR

ii) BSc. With chemistry& with two year post qualification experience in the relevant field.

5) **Tools, Equipments & Machinery required** : - As per Annexure – II

7.2.1 BROAD SKILL COMPONENT TO BE COVERED DURING ON-JOB TRAINING

A. BLOCK – I

Duration: 9 months (39 Weeks)

SHOP TRAINING (Quality Control Lab /Chemical Lab): -

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
2.7	Behavior based safety (BBS)
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 cover before operating each laboratory equipment*)**	
3.	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.
4.	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.
Metallurgical analysis	
5.	**Atomic Absorption Spectrophotometry** Analysis of different sample (such as Cu, Fe, Mn. etc.) on Atomic Absorption

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

B. BLOCK – II
Duration: 9 months (39 Weeks)

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 cover before operating each laboratory equipment*)

1.	**Thin Layer Chromatography (TLC):** Separation of different sample mixture on thin layer chromatography.
2.	**Gas Chromatography Mass Spectrometry (GC / MS) :** Identification of different sample by using GC/ MS
3.	**UV – Vis Spectroscopy** : Determination of percentage composition of different sample components
4.	**Fourier Transform Infrared Spectrophotometer (**IR/FTIR Spectrophotometer): 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
5.	Water, sources of water, Different water treatment processes, demineralised (DM) water , Industrial water ,potable water Different water samples available in industry and their sampling techniques. 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.
6.	Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Dissolved Oxygen(D.O), Determination of COD, BOD, DO for different water sample /effluent.
7.	Determination of mixed liquor suspended solids (MLSS), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), P^H, Turbidity of given water sample. Analysis for Some Minute Minerals like Magnesium (Mg), Potassium (K), Sodium (Na), Arsenic (As), etc. Hard water , Soft water
8.	Detection of 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.
9.	Detection of elements, functional group, Melting point, Boiling point , Technique of purification, preparation of Compound derivatives
10.	Preparation of organic compounds such as Acetanilide, Aspirin, Phenolphthalein, soap, Glucosazone etc.
11.	Microbiological analysis Culture, Collection, Sampling,
12.	Detection, preparation of innocula, Media, Techniques of inoculation & staining
13.	Handling equipments in microbiological lab. Centrifuge, pH-Meter, incubator, Shaker
14.	Sterilization, fermentation, formulation. Preparation of Solutions related with microbiological lab.

8. ASSESSMENT STANDARD

8.1 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 to be given while assessing for team work, avoidance/reduction of scrape/wastage and disposal of scarp/wastage as per procedure, behavioral attitude and regularity in training.

The following marking pattern to be adopted while assessing:

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

For 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.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- many tolerances while undertaking different work are in line with those demanded by the component/job.
- 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 under following performance level:

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.

In this work there is evidence of:

- good skill levels in the use of hand tools, machine tools and workshop equipment
- the majority of tolerances while undertaking different work are in line with those demanded by the component/job.
- 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 under following performance level:

For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.

In this work there is evidence of:

- high skill levels in the use of hand tools, machine tools and workshop equipment
- tolerances while undertaking different work being substantially in line with those demanded by the component/job.
- a high level of neatness and consistency in the finish.
- minimal or no support in completing the project

8.2 FINAL ASSESSMENT- ALL INDIA TRADE TEST (SUMMATIVE ASSESSMENT)

SUBJECTS	Marks	Internal assessment based on competency	Full Marks	Pass Marks	Duration of Exam.
Basic Training(Block-I)		**250**	**250**	**150**	
Professional Skill	250		250	150	**08 hrs.**
Professional Knowledge	100		100	40	3 hrs.
Workshop Cal. & Sc.	50		50	20	3 hrs.
Engineering Drawing	50		50	20	4 hrs.
Employability Skill	50		50	20	3 hrs.
Basic Training (Block-II)		**250**	**250**	**150**	
Grand Total	**500**	**500**	**1000**	**550**	

Marks Distribution TOTAL: 1000 marks for I & II Blocks Pass marks: 550

Note: - The candidate pass in each subject conducted under All India Trade Test.

9. FURTHER LEARNING PATHWAYS

On successful completion of the course,

- The trainees will be employed in reputed Industries / Organizations./ Quality control lab /chemical laboratory
- On successful completion of the course trainees can opt for Degree course (lateral entry).

Employment opportunities:

On successful completion of this course, the candidates shall be gainfully employed in the following industries:

1. Production & Manufacturing industries.
2. Pharmaceutical Industries.
3. Dyes and Dyes intermediate Industries.
4. API Manufacturing Industries.
5. Pesticides Manufacturing Industries.
6. Petroleum Refinery and oil Manufacturing Industries.
7. Infrastructure and defence organisations.
8. Sugar and Alcohol Manufacturing Industries.
9. Pulp and Paper Manufacturing Industries.
10. Cement Manufacturing Industries.
11. In public sector industries like GSFC, BPCL, NTPC,GNFC,IOCL,RCF etc and private industries in India & abroad.
12. Self employment

ANNEXURE – I

10. TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: CHEMICAL LABORATORY ASSISTANT

1) LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A: TRAINEES TOOL KIT:-

Consumable item (As required)

Sl. No.	Name of the items	Quantity (indicative)
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 : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sl. No.	Name of the items	Quantity (indicative)
1.	Digital balances of different makes 200 gram 0.001 mg	1 No
2.	Digital Balance capacity 1Kg, accuracy 1gram	1 No
3.	Various types of Viscometer (Redwood, Ostwald, Brooks field)	Any Two
4.	Shaker (Bottle, Flask etc.)	1 No
5.	Mechanical board for testing triangle and parallelogram of forces including all accessories.	2 Set
6.	Instrument for determining 'g' (simple pendulum).with stand	2 Set
7.	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
8.	Polarimeter Digital	1 set
9.	Digital refractometer	1 no
10.	Equipment to study Kirchoff's Law	1 set
11.	Resistance Box (50 ohms, 100 ohms)	2 no
12.	(a) Rheostat 25 Ohms (b) Rheostat 100 Ohms	1 no each
13.	Ammeters with stands: (a) 0 to 1 Amp (DC) (b) 0 to 3 Amp (DC)	 2 sets 2 sets
14.	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
15.	Mill voltmeter : (a) 0 to 5 mV (b) 0 to 500 mV	 2 sets 2 sets
16.	Digital Multi meter	1 no
17.	DC Power supply 12 V, 2 A	2 no
18.	Water baths (6 places)(Electrically heated)	1 no
19.	Sand bath	1 no
20.	pH meter Digital	1 no
21.	Auto titrator	1 no

22.	Conductivity meter	1 no
23.	Magnetic stirrers (with heating plate) 2 liters capacity	2 no
24.	Mortar, 100mm, porcelain with pestle	2 no
25.	Heating plates (Electrical) 1000 watt	2 no
26.	Melting point apparatus	1 no
27.	Apparatus for determination of flash point	1 no
28.	Bunsen's burners	16 no
29.	Steam generator (copper) for steam distillation 2 liter capacity	4 no
30.	Distilled water plant 4 liter /Hr	1 no
31.	TDS Meter digital	1
32.	Heating Mental 1,2 & 5 liter	1 set
33.	COD Apparatus	1
34.	BOD Apparatus	1
35.	Incubator	1
36.	Microscope	1
37.	Electro chemical equivalent	1

Note: All electrical equipment should be provided with extra 20 meter wire switches, terminals for connection.

C : GENERAL MACHINERY INSTALLATIONS:-

Sl. No.	Name & Description of Machines	Quantity (indicative)
1.	Vacuum Pump With Trolley	1 no
2	Electric Drying oven (200 ^{o}C)	1 no
3	Furnaces (Muffle oven)(1100 ^{o}C)	1 no
4	Fire Extinguisher	1 no
5	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 20 APPRENTICES

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

2) Infrastructure:

A : TRAINEES TOOL KIT:-

Sl. No.	Name of the items	Quantity (indicative)
1.	Draughtsman drawing instrument box	20 nos
2.	Set square celluloid 45º (250 X 1.5 mm)	20 nos
3.	Set square celluloid 30º-60º (250 X 1.5 mm)	20 nos
4.	Mini drafter	20 nos
5.	Drawing board (700mm x500 mm) IS: 1444	20 nos

B : FURNITURE REQUIRED

Sl. No.	Name of the items	Quantity (indicative)
1	Drawing Board	as required
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

ANNEXURE – II

11. INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: **CHEMICAL LABORATORY ASSISTANT**

For Batch of 20 APPRENTICES

Actual training will depend on the existing facilities available in the establishments. However, the industry should ensure that the broad skills defined against On-Job Training part (i.e. 9 months + 9 months) are imparted. In case of any short fall the concern industry may impart the training in cluster mode/ any other industry/ at ITI.

List of Accessories & Machines for CHEMICAL LAB ASSISTANT may be available with Industry

1) Gas Chromatography
2) Gas Chromatography – Mass spectrograph (GC/MS)
3) High Performance Liquid Chromatography (HPLC)
4) Thin Layer Chromatography (TLC)
5) IR/FT – IR Spectrophotometer [Fourier Transform Infrared Spectrometer]
6) Turbidimeter
7) Atomic Absorption Spectrophotometer
8) Ultraviolet–visible spectroscopy (UV-Vis spectroscopy)
9) pH-meter
10) X-ray crystallography
11) Flame photometry
12) Electron Microscope
13) Digital Balance
14) Sieve analyzer
15) Demineralization (DM) Water treatment plant
16) Centrifuge
17) Incubator
18) Shaker
19) Sterilizer
20) Air monitoring system

ANNEXURE-III

13. GUIDELINES FOR INSTRUCTORS AND PAPER SETTERS

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

A) LECTURE
B) LESSON
C) DEMONSTRATION
D) PRACTICE
E) GROUP DISCUSSION
F) DISCUSSION WITH PEER GROUP
G) PROJECT WORK
H) INDUSTRIAL VISIT

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

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