CURRICULUM

FOR THE TRADE OF

ATTENDANT OPERATOR (CHEMICAL PLANT)

UNDER

APPRENTICESHIP TRAINING SCHEME

सत्यमेव जयते
Government of India

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

CONTENTS

Sl. No.	Topics	Page No.
1.	Acknowledgement	3-4
2.	Background 2.1Apprenticeship Training under Apprentice Act 1961 2.2 Changes in Industrial Scenario 2.3 Reformation	5-6
3.	Rationale	7
4.	Job roles: reference NCO	8
5.	General Information	9
6.	Course structure	10-11
7.	Syllabus 7.1 Basic Training 7.1.1 Detail syllabus of Core Skill A. Block-I (Engg. drawing & W/ Cal. & Sc.) B. Block-II (Engg. drawing & W/ Cal. & Sc.) 7.1.2 Detail syllabus of Professional Skill & Professional Knowledge A. Block – I B. Block – II 7.1.3 Employability Skill 7.1.3.1 Syllabus of Employability skill A. Block – I B. Block – II 7.2 Practical Training (On-Job Training) 7.2.1 Broad Skill Component to be covered during on-job training. A. Block – I B. Block – II	12-28
8.	Assessment Standard 8.1 Assessment Guideline 8.2 Final assessment-All India trade Test for Apprentice	29-31
9.	Further Learning Pathways	32
10.	Annexure-I – Tools & Equipment for Basic Training	33-36
11.	Annexure-II – Tools & Equipment for On-Job Training	37
12.	Annexure-III - Guidelines for Instructors & Paper setter	38

1. ACKNOWLEDGEMENT

The DGT sincerely express appreciation for the contribution of the Industry, State Directorate, Trade Experts and all others who contributed in revising the curriculum. Special acknowledgement to the following industries/organizations who have contributed valuable inputs in revising the curricula through their expert members:

1. DVET , Maharashtra State
2. D.E.T., Gujarat State
3. Rashtriya Chemicals &Fertilizers Limited, Chembur, Mumbai
4. Bharat Petroleum Corporation Ltd., Mahul Refinery, Mumbai
5. Gujarat State Fertilizer Company Limited, Vadodara Gujarat
6. GSP Crop Science Pvt. Ltd. Nandesari, Vadodara
7. Nitrite Ltd., Nandesari, Vadodara
8. INEOS Styrolution India Ltd., Nandesari, Vadodara
9. Rubamin Ltd., Nandesari, Vadodara
10. Farmson Analgesic, Nandesari, Vadodara
11. Technology Exchange, Ahmedabad
12. Nish Automation, Ahmedabad
13. Masibus Automation, Ahmedabad

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

Co-coordinators for the course: Shri Sunil Wakde ,ADT, ATI, Mumbai and

Shri L K Mukherjee, DDT, CSTARI, Kolkata

Sl. No.	Name & Designation Sri /Mr./Ms.	Organization	Remarks
1.	SA Pandav, RDD, Vadodara & Surat	DET, Gujarat	Expert
2.	Rajendra Mandora, Manager	Nish Automation,	Expert
3.	Sunil Wakde , Assistant Director (Training)	ATI, Mumbai	Expert
4.	Sri R. C. Sonavane, Craft Instructor	BTRI, Panvel	Expert
5.	Sri C. P. Jadhav , Craft Instructor	BTRI, Panvel	Expert
6.	Sri S.I. Rajput ,Craft Instructor	Govt. ITI. Mahad	Expert
7.	Sri N.J. Ware , Craft Instructor	Govt. ITI. Mahad	Expert
8.	Smt. S.G. Thakur ,Training Officer	Govt. ITI. Mahad	Expert
9.	Rupesh Shah, Sr. Manager	Masibus Automation,	Expert
10.	DK Sharma, MD	Technology Exchange, Ahmedabad	Expert
11.	Kamlesh Prajapati, Director	Technology Exchange, Ahmedabad	Expert

12.	Shri Sudhir Joshi, Dy. Manager (Trg. & HRD)	GSFC Ltd., Vadodara	Expert
13.	Shri Paresh Faldu, Sr. Manager (QC & QA)	GSP Crop Science. Pvt. Ltd., Nandesari, Vadodara	Expert
14.	Shri Navin Chauhan, Sr. Manager (Production)	Deepak Nitrite Ltd., Nandesari, Vadodara	Expert
15.	Shri Sunil Patel, Dy. Manager (QA)	INEOS Styrolution India Ltd., Nandesari, Vadodara	Expert
16.	Shri Chirag J. Patel, Maintenance Manager	Rubamin Ltd., Nandesari, Vadodara	Expert
17.	Shri Falgun Patel, Production Manager	Farmson Analgesic, Nandesari, Vadodara	Expert
18.	Smt. S. B. Sarvaiya, Principal	ITI Savli, Di-Vadodara	Expert
19.	Shri D. R. Sanchala, I/C Asst. Appre. Advisor	ITI Dashrath, Di-Vadodara	Expert
20.	Shri Nilesh H Patel I/C Asst.Appr. Advisor	ITI Tarsali, Vadodara	Expert
21.	Shri J P Gadhavi I/C Asst.Appr. Advisor	ITC Tarsali, Vadodara	Expert
22.	Sri K.C. Babu, Officer (HRD)	R.C.F., Mumbai	Expert

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 "**Attendant Operator (Chemical Plant)"** trade]

In chemical process Industries required qualified operator who having skill and knowledge of Unit operations and unit process and instrumentation and safely working chemical plant.

After completion of 2 year Apprenticeship Training in AOCP Trade, he/she will gain the skill and knowledge of Unit operations and unit process of chemical process industries.

- Enhancement of training for preparing skilled man power as per need of 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.
- Up-gradation of employability ratio.

4. JOB ROLES: REFERENCE NCO

Brief description of Job roles:

- Works as an operator /supervisor in chemical process industries.
- Operations of different equipments and machineries of Chemical plants.
- Maintenance of different equipments and machineries in chemical plant
- To accomplish various Unit Operations for achieving the different parameters concerned to the plant requirement.

Reference NCO:
8142.10, 8142.15, 8142.40, 8142.50, 8142.90, 8143.15, 7422.65, 8151.15, 8151.30, 8151.60, 8152.10, 8152.30, 8152.60, 8153.10, 8153.40, 8154.20, 8154.40, 8155.10, 8159.34, 8276.81, 8159.64, 8159.72, 8159.76, 8159.82, 8159.86, 8276.10, 8276.20, 8276.81, 8276.50, 8276.70,8275.50,8275.40, 8131.60, 8231.10, 8231.67, 8231.20, 8122.10, 8142.20, 8142.45, 8143.10,8143.25, 8151.30, 8151.10, 8151.60, 8152.15, 8152.25, 8152.90, 8153.30, 8154.10, 8154.30, 8159.88, 8159.30, 8159.42, 8159.62, 8159.68, 8159.74, 8159.80, 8159.84, 8159.88, 8276.23, 8276.20, 8276.40, 8276.60, 7414.40, 8275.65, 8272.10, 8231.65, 8231.15, 8231.30

5. GENERAL INFORMATION

1. **Name of the Trade : Attendant Operator (Chemical Plant)**

2. **N.C.O. Code No.** : 8142.10, 8142.15, 8142.40, 8142.50, 8142.90, 8143.15, 7422.65, 8151.15, 8151.30,8151.60, 8152.10, 8152.30, 8152.60, 8153.10, 8153.40, 8154.20, 8154.40, 8155.10, 8159.34, 8276.81, 8159.64, 8159.72, 8159.76, 8159.82, 8159.86, 8276.10, 8276.20, 8276.81, 8276.50, 8276.70,8275.50,8275.40, 8131.60, 8231.10, 8231.67, 8231.20, 8122.10, 8142.20, 8142.45, 8143.10,8143.25, 8151.30, 8151.10, 8151.60, 8152.15, 8152.25, 8152.90, 8153.30, 8154.10, 8154.30, 8159.88, 8159.30, 8159.42, 8159.62, 8159.68, 8159.74, 8159.80, 8159.84, 8159.88, 8276.23, 8276.20, 8276.40, 8276.60, 7414.40, 8275.65, 8272.10, 8231.65, 8231.15, 8231.30

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/B.Sc. Passed: - Duration of Basic Training**: - NIL

Duration of Practical Training (On -job Training): 12 months

4. **Entry Qualification:**

1. Passed 10th class examination under 10+2 system of education with Science & Mathematics or its equivalent.

5. **Selection of Apprentices:** The apprentices will be selected as per Apprentices Act amended time to time.

6. **Rebate to ITI/Bsc Passed out Trainees:** i) One year for the trade of AOCP
ii) One year for BSc passed (PCM or PCB)

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** : **Attendant Operator (Chemical Plant)**
2) **Hours of Instruction** : 1000 Hrs. (500 hrs. in each block)
3) **Batch size** : 20
4) **Power Norms** : 13 KW for Workshop
5) **Space Norms** : 110 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) NTC/NAC in the trade of AOCP with three year post qualification experience in the relevant field.

Preference will be given to a candidate with Craft Instructor Certificate (CIC)

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: - Single Stroke, Double Stroke, inclined, Upper case and Lower case **(4 Hrs)**		**Fractions** : Fractions, Decimal fraction, L.C.M., H.C.F. Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator. **(2Hrs**)	**Mass ,Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals. **(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 res**pective trades. **(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, Plug Valve, check valve etc. **(4 Hrs)** **Drawing of different types locking devices** such as double nut, castle nut, pin etc.**(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	**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. **(2 Hrs)** **Free hand sketches** of Belt conveyor, Screw conveyer, Bucket elevator **(4 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	**Drawing of pressure, Level , flow and temperature control system.** **(2 Hrs)** **Free hand sketches** of crushers, ball mill, hammer mill and centrifuges **(4 Hrs)**		Centre of Gravity, (C.G. Of square, rectangle, triangle, circle, semicircle, cone) & its calculations **(2 Hrs)**	Condition of equilibrium, kind of equilibrium, some examples of equilibrium in daily life,. **(2 Hrs)**	
4	**Free hand sketches** of steam jet ejector, steam trap **(2 Hrs)** **Diagram of distillation column** with all accessories Free hand sketches of process instrument- such as temperature indicator, level indicator, LIC, TIC, PI, PIC, FI, FIC **(4 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	Flow sheet / Block diagram of 1.Sulphuric acid 2.Nitric acid 3.Ammonia 4. Urea 4. Ethanol		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

Basic Training

Week No.	Professional Skills (275Hrs)	Professional Knowledge (120 Hrs)
1	1.Introduction of glass wares used in chemical Laboratory 2.Acid Base Titration	Introduction of Chemistry, branches of chemistry, importance of chemistry, Safety precautions to be taken in Chemistry Laboratory, different equipment and apparatus used in Laboratory
2	1.Acid Base Titration 2.Preparation of soap	Atom, molecule, Element, compound, mixture, Physical change, chemical change, Acids, bases, salts &their properties. Molecular weight, equivalent weight, atomic weight, Normality, molarity.
3	1.Simple Distillation 2. Fractional Distillation	Sources of water, hard and soft water, causes and removal of hardness,
4	1.Boiling Point 2.Melting Point 3.PH Measurement	Purification processes, organic reactions, Boiling point, Melting point, Distillation
5	1.Law of parallelogram of forces 2.Coefficient Of Static Friction	Introduction to Physics, Scalar and Vector quantities, their representation, resultant. Triangle and parallelogram laws of forces.
6	1. M.A,V.R,& Efficiency by inclined plane 2. ‘ g’ by simple pendulum	Simple machine Inclined plane, Lever, Screw jack, pulley Motion –uniform ,circular & rotational motion
7	1. Coefficient Of cubical expansion 2. Coefficient Of linear expansion 3. Thermal conductivity of metal	Modes of heat transfer, determination of thermal conductivity. Temperature & its measurement, expansion of solid, liquid and gases
8	1. Verification of ohm’s law 2. Specific resistance of wire by Wheatstone bridge	Electricity- Ohm's law, series & parallel connections, specific resistance
9	1. ECE of Copper 2. J by electrical method	Electrolysis Faraday’s First & Second law of electrolysis Calorimetry , mechanical equivalent of heat, 'J' by electrical method
10	1.Pipe Fitting 2.Gasket cutting	Different types of pipe joints, Gasket materials for particular applications-cork sheet, oil-proof paper etc
11	Dismantle, clean & Reassemble of different types of valve	Construction, working and uses of various types of valves.
12	Dismantle, clean & Reassemble of different types of Pump Operation of Centrifugal pump, Reciprocating pump and Gear Pump .	Construction, working and uses of various types of Pumps
13	Revision	
	Internal Assessment 03days	

B. Block –II
Basic Training

Week No.	Professional Skills (275Hrs)	Professional Knowledge (120 Hrs)
1.	Occupational Safety & Health. Importance of housekeeping & good shop floor practices. Introduction to safety equipment and their uses in chemical plant. Personal protective Equipments (PPE). Use of Fire extinguishers Study of chart of MSDS Of chemicals which is mostly used in chemical industry.	Role of Attendant Operator in chemical plant. Introduction about chemical industrial work Introduction to Unit Operations and Unit processes, their meanings. Features of unit Operations. Soft Skills: its importance and Job area after completion of training Introduction of First aid. Operation of electrical mains. Introduction of PPEs. Introduction to 5S concept & its application. Response to emergencies eg; power failure, fire, and system failure. **MSDS of Chemicals**:- Material safety data sheet of Acid, Base , Hydrocarbon & Solvents
2&3.	To determine viscosity of liquid by Brooks field viscometer. To determine Reynolds's number and hence the type of flow either laminar or turbulent. Flow measurement & Calibration of flow meters.	**Flow of Fluid:** Definition of fluid , compressible fluid, incompressible fluid. Properties of fluid-viscosity, Manometer, Reynolds's Number, Flow measuring devices.
4.	To operate Shell and Tube heat exchanger and calculate rate of heat transfer.	**Heat Transfer:** Mechanism of Heat Transfer in solid, liquid and gases and their application in industries, thermal conductivity. Heat transfer equipment.
5.	To operate vertical tube evaporator.	**Evaporation:** Definition, classification of evaporators, Capacity, steam economy of evaporators.
6.	Separation of binary liquid mixture by distillation	**Distillation:** Concept of distillation, Flash differential, rectification and azeotropic, extractive, vacuum, steam distillation. Reflux ratio: minimum, total, optimum, importance of reflux ratio. Types of distillation column.
7&8.	Operation of mixer settler Study of spray extraction column	**Manufacturing Process of Sulphuric Acid and Nitric Acid :**Raw materials, chemical reactions, process description, flow sheet, uses. **Solvent Extraction:** Introduction, definition, choice of solvent,. Equipments used for extraction **Leaching:** Application and different types of equipment uses for leaching

9.	Flooding velocity experiment using a packed glass column	**Absorption:** Introduction, equipment's used for absorption – columns, factors affecting rate of absorption, types of packing, flooding and flooding velocity.
10.	Operation of Plate and frame filter press Operation of Rotary Vacuum Filter Operation of Top/ Bottom driven centrifuge	**Manufacturing process of Ammonia, urea and Ethyl alcohol:** Raw materials, chemical reactions, process description, flow sheet, uses **Filtration:** Principles of filtration, types of filtrations & its applications. Rate of filtration Classification, construction & working of different types of filters used in industries.
11.	Finding rate of drying by using tray dryer	**Drying:** Theory, types of dryers and their uses.
12.	Operation of Blake jaw crusher Operation of Ball mill	**Size Reduction:** Introduction to crushing & grinding, construction, working and applications of size reduction equipment
13.	To carry out sieve analysis with a sieve shaker	**Screening:** Mesh number , Classification of Screening equipment's.
	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**	**:**	

7. 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

8. 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** : **Attendant Operator (Chemical Plant)**

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

b) Maximum 20 candidates 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 CHMICAL Engg. From recognized university/Board With one/two year post qualification experience in the relevant field.

OR

ii) NTC/NAC in the trade of AOCP with three year post qualification experience in the relevant field.
Preference will be given to a candidate with Craft Instructor Certificate (CIC)

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

1. **Safety and best practices (5S, KAIZEN etc.)**
2. **Store procedure, Record keeping, inventory management and documentation**
3. **Identification and testing of equipments and machineries of chemical plant.**
4. **Repair & Maintenance work of equipments and machineries of chemical plant**

DURATION : 09 MONTHS (39 WEEKS)	
List of operations in Petro Chemicals, heavy chemicals, fire chemicals, paper and pulp, Cement, pharmaceutical ,Fertilizer and allied chemical industries	
Sl. No	**List of operations/skills to be covered during Industrial Training**
1.	Introduction in safety precautions as applicable to the trade
2.	**Orientation** i) The General Plant Knowledge and its products, raw materials used capacity of production etc. (ii) Different sections of the plant including process, Co ordination of maintenance and their activities. (iii) Study of the process and operations carried out in the establishment with the help of Simple flow sheet under the guidance of plant-in –charge/supervisor/familiarization with the equipments used in the establishment by actually going round the plant. (iv) Writing report (Diary of day-to-day work.)
3.	**Safety** iii) Cause and prevention of accidents first aid to the injured. (ii) Personal safety and use of personal protective equipment (iii) House keeping (iv) Fire hazards & Toxic hazards on site & offsite emergencies. (v) Isolation of equipment's and ancillaries prior to handing.
4.	Familiarization with utilities and service lines such as steam, cooling water, chilled water, brine, vacuum, compressed air, refrigeration, air Handling units etc. Familiarization with colour code system of pipe lines used in chemical industries
5.	Standard operating procedure (SOP), process conditions and the corrective action in case of the following equipment available in the industry. (i) Flow meters, pipe fitting and joints, Pumps, compressors, blowers, fans, steam ejectors

	etc.. (ii) Heat exchangers, condensers, coolers, chillers, re-boilers ,boilers, furnaces, kilns. Etc. (iii) Distillation columns etc. (iv) Evaporators, and refrigeration units. (v) Solvent (liquid –liquid) Extraction units and leaching (solid –liquid) extraction units (vi) Agitation ,mixing and blending equipments (vii) Effluent Treatment Plant (viii) Water Treatment Plant (ix) Storage and handling, vessels ,Chemical Reactors (x) APCM (Air pollution control Measures) ESP /cyclone separator/ Venturi scrubber, Bag filter

BLOCK – II

1. **Safety and best practices (5S, KAIZEN etc.)**
2. **Store procedure, Record keeping, inventory management and documentation**
3. **Identification and testing of equipments and machineries of chemical plant.**
4. **Repair & Maintenance work of equipments and machineries of chemical plant**

DURATION: 09 MONTHS (39 WEEKS)	
List of operations in Petro Chemicals, heavy chemicals, fire chemicals, paper and pulp, Cement, pharmaceutical , Fertilizer and allied chemical industries	
Sl. No	**List of operations/skills to be covered during Industrial Training**
1.	**Quality Control** Familiarization with sample quality control tests.
2.	**Routine Plant Jobs** (i) Aware with Start up & shut down of equipment or opening and closing of pipeline. (ii) Taking Reading of pressure and vacuum gauges, thermometers etc. winding of recorders (iii) Removal of chart and inking of pens of recorders. (iv) Replacement of packing seal/gasket seal in pipe flanges. (v) Changing of belts coupling, Chain etc. (vi) Operating Process of evaporator tubes, heat exchangers etc. (vii) Mitigation of emergencies in the plant i.e. leakage / fix / process chemicals –Toxic Hazards
3	Reading Maintaining and controlling of process control instruments measuring, flow, temperature, pressure, pH, concentration etc., Their inter locking system, automatic signaling instruments for high or low pressure temperature, flow etc.
4	Standard operating, procedure(SOP), process conditions and the corrective action in case of the following equipment available in the industry. (ii) Absorption towers. Adsorption equipments iv) Drying Operation. (iv) Crystallizing Operation. (v) Filtration equipments (vi) Sedimentation and coagulation (vii) Size separation and grinding equipment. (viii) Crushing and grinding equipment. v) Material handling and conveying equipment

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 FOR APPRENTICE

SUBJECTS	Marks	Sessional Marks	Full Marks	Pass Marks	Duration of Exam.
Practical	300	100	400	240	**08 hrs.**
Trade Theory	100	20	120	48	3 hrs.
Workshop Cal. & Sc.	50	10	60	24	3 hrs.
Engineering Drawing	50	20	70	28	4 hrs.
Employability Skill	50	--	50	17	2 hrs.
Grand Total	**550**	**150**	**700**	**-**	

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

9. FURTHER LEARNING PATHWAYS

- On successful completion of the course trainees can opt for Diploma course (lateral entry). {Applicable for candidates only who undergone ATS after CTS}
- They can also undergo CITS course in the relevant trade to become instructor in the ITI's

Employment opportunities:

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

1. Chemical Process industries.
2. Petroleum refineries and petrochemical industries
3. Fertilizer industry and allied industries.
4. Defence organisations such as ordinance factories
5. In public sector industries like IOCL, BPCL, HPCL, RCF,BARC, HWB etc and private industries in India & abroad.
6. Self employment

ANNEXURE – I

10.TOOLS & EQUIPMENT FOR BASIC TRAINING

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

TRADE: Attendant Operator (Chemical Plant)

LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES

A : TRAINEES TOOL KIT:-

CONSUMABLE ITEMS

Sr. No.	Name of the items	Quantity (indicative)
1	Ear Plug	20
2	Nose Mask	20
3	Specific Gravity bottle 25 cc	6
4	Bunsen Burners	10
5	Tripods Stand	10
6	Asbestos wire gauge 8”	20
7	Burettes 25ml boroflow type borosilicate Glass	10
8	Measuring Pipettes 10ml borosilicate glass	05
9	Clamp holders	20
10	Stands with clamps for burette	10
11	Measuring cylinder 500 ml borosilicate glass	05
12	Measuring cylinder 100 ml borosilicate glass	10
13	Volumetric flask 100 ml borosilicate glass	10
14	Volumetric flask 250 ml borosilicate glass	05
15	Funnels Dia 7.5cms borosilicate glass	05
16	Beaker 100ml corning	10
17	Beaker 250ml corning	10
18	Beaker 500ml corning	05
19	Bottles for solutions 1000 ml borosilicate glass	04
20	Conical flask – 100 ml borosilicate glass	10
21	Conical flask – 250 ml borosilicate glass	10
22	Tong – Flat – 300 mm	20
23	Spatula – 8”	05
24	Round Bottom Distillation flask with side neck 250ml borosilicate glass	05
25	Round Bottom Distillation flask with side neck 500ml borosilicate glass	05
26	Water Condenser for distillation lebig 30 cm long borosilicate glass	05
27	Rubber cork of (2.5 cm, 3cm) size Various size	10
28	Wooden cork of (2.5 cm, 3cm) size Various size	10
29	Rubber Tubing Heavy Duty (ID- 5mm)	10 meter
30	Rubber Bulbs for pipettes (Teat)	02
31	Hydrometer 0-1200 with measuring Cylinder 1000 ml	02

B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS

Sr. No.	Name of the items	Quantity (indicative)
1.	Safety Goggles	20
2.	Safety hand gloves leather (Regular size)	20
3.	Fire Extinguishers (Dry Chemical powder)	01
4.	Fire bucket	05
5.	Pipe wrench 12”	01
6.	Pipe wrench 18”	01
7.	Double Ended Spanner set Metric 6*7 to 30*32	01
8.	Combination Plier	05
9.	Screw Driver – 9 X 300 mm	05
10.	Hammer – Ball Pein – 500 grams	05
11.	Chisel – Cold – Flat – 20 mm X 150 mm	05
12.	Hollow punch	05
13.	Snip for gasket cutting	02
14.	Instrument for determining ‘g’ (Simple Pendulum) complete set	02
15.	Mechanical board for testing triangle and parallelogram of forces including all accessories	02
16.	Inclined plane with pulley, pan, weights etc.	02
17.	Calorimeter for determining Joule’s mechanical Equivalent of heat by electric method	02
18.	Apparatus for measurement of co-efficient of expansion(thermal) of solid (plunger’s apparatus)	02
19.	Apparatus for measurement of thermal conductivity of good and bad conductors complete set	02
20.	Thermometers of different range as per requirement	01
21.	Rheostat 100 ohms	02
22.	Resistance box 0 to 1000 ohms	02
23.	Nicrome Wire Resistance of 50cm long 2 ohm,3 ohm,5 ohm	02 each
24.	Battery eliminator	02
25.	Copper voltmeter for Electrochemical equivalent	02
26.	Ammeter 0 to 1000 mA. (DC)	02
27.	Voltmeter 0 to 15 volt (DC)	02
28.	pH Meter digital	01
29.	Steam generator (copper) Cap. 1000ml	06
30.	Vernier caliper – 0 – 200 mm with least count 0.02mm	02
31.	Micrometer 0 – 25 mm	02
32.	Water bath 6 places	02
33.	Wheatstone bridge apparatus with 1m long wire	02
34.	Different types of pipe fittings	01 set
35.	Different types of valves	01 set
36.	Different types of pumps	01 set
37.	Stop watch 1/10 sec Racer make	02
38.	Digital balance 0.1 mg to 200 gms	01

C : GENERAL MACHINERY INSTALLATIONS:-

Sr. No.	Name & Description of Machines	Quantity (indicative)
1.	Reynold's equipment	01
2	Shell and Tube heat exchanger	01
3	Packed distillation tower.	01
4	Mixer-settler type extractor	01
5	spray extraction column	01
6	Cooling Tower	01
7	Plate and frame filter press and Rotary vacuum Filter	01 each
8	Top driven centrifuge	01
9	Tray dryer	01
10	Blake jaw crusher	01
11	Ball mill	01
12	Sieve shaker and sieves	01
13.	Different types of pipe fittings and joints	2 sets
14.	PLC and DCS Training Kit	1 each
15.	Different types of pumps (Centrifugal pump, Reciprocating and Gear pump test rigs)	One each
16.	Digital Viscometer	01
17.	Flow meter Test rig (Rotameter- Venturimeter- Orifice meter – Pitot Tube-water meter)	01set
18.	Air Compressor Test Rig	1
19	Vertical Tube Evaporator	1
20	Plant for Operator having various operations like heat exchanger, condenser, evaporator, distillation, pumps, valves and instrumentation controls etc	1

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: **Attendant Operator (Chemical Plant)**

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
2.	Set square celluloid 45^0 (250 X 1.5 mm)	20
3.	Set square celluloid 30^0-60^0 (250 X 1.5 mm)	20
4.	Mini drafter	20
5.	Drawing board (700mm x500 mm) IS: 1444	20

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

INFRASTRUCTURE FOR ON-JOB TRAINING

TRADE: **Attendant Operator (Chemical Plant)**

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.

11.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.