

**CURRICULUM**

**FOR THE TRADE OF**

**ATTENDENT OPERATOR**  
**(CHEMICAL PLANT)**

**UNDER**

**DUAL TRAINING SCHEME**

**2017**

**BY**



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

PROPOSED TIME DISTRIBUTION FOR AOCPTRADE  
UNDER DUAL TRAINING SCHEME

<b>BLOCK WITH DURATION</b>	<b>THEORY</b>	<b>PRAC.</b>	<b>WSC/ CAL</b>	<b>ENGG. DRG.</b>	<b>EMP. SKILL</b>	<b>ECA, LIB. &amp;OTHE</b>	<b>REM.</b>
BLOCK – I (12 months/52 Weeks duration) Institute level trg.	510 hrs.	830 hrs.	170 hrs.	250 hrs.	110 hrs.	50 hrs.	160 hrs. Revision & Test
BLOCK – II (09 months /39 weeks duration) Industry level trg.	---	1560 hrs.	---	---	---	---	---
BLOCK – III (3 months/ 13 Weeks duration) Institute level trg.	100 hrs.	210 hrs. (Practical practice and submission of report related to	50 hrs.	60 hrs.	---	20 hrs.	Last 2 weeks revision & exam.
<b>GRAND TOTAL</b>	<b>610 Hrs.</b>	<b>2600 Hrs.</b>	<b>220 Hrs.</b>	<b>310 Hrs.</b>	<b>110 Hrs.</b>	<b>70 Hrs.</b>	<b>240 Hrs.</b>
<b>Total duration of training inclusive of Industry&amp; Institute is 2 years (4160 Hrs.)</b>							

## GENERAL INFORMATION FOR INSTITUTE (ITI)

1. **Name of the Trade** : **ATTENDANT OPERATOR  
(CHEMICALPLANT)**
2. **NCO Code No.** : 8131.0100, 8131.0200, 8131.0400,  
8131.1400, 8131.2100, 8131.2200,  
8131.2300, 8131.2600, 8131.2700,  
8131.3600, 8131.3700, 8131.3900,  
8131.6500, 8131.7700, 8131.9900,  
3133.0600, 8171.0100, 8171.0200,  
3139.0300, 3133.0100, 3133.0500,  
8160.5200, 8160.3400.
3. **Duration of Craftsmen Training** : 2 Years (Three Blocks )
4. **Power Norms** : 13 KW
5. **Space Norms** : 104 sq. mtrs.
6. **Entry qualification** : Passed 10<sup>th</sup> Class Examination under  
10+2 system with Science and  
Mathematics or equivalent.
7. **Trainees per unit** : 16 (Max. supernumeraries seats: 5)
8. a) **Instructor's Qualification** : Degree in Chemical Technology/  
Engineering from recognized University  
with one experience in relevant field.  
OR  
Diploma in Chemical Technology/  
Engineering from recognized board of  
Technical Education with 2 years post  
qualification experience in relevant field  
OR  
10<sup>th</sup> Class Passed and NTC / NAC in Trade  
of AOCB with 3 years post qualification  
experience in the relevant field
8. b) **Desirable qualification** : Preference will be given to a candidate  
with Craft Instructor Certificate (CIC) in  
**AOCB** Trade.

### Note:

- i) Out of two instructors required for the unit of 2 (1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.
- ii) Instructor qualification for WCS and ED, as per the training manual.

**Distribution of training on Hourly basis:**

Total hours /week	Trade practical	Trade theory	Work shop Cal. &Sc.	Engg. Drawing	Employability skills	Extra curricular activity
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

## SYLLABUS CONTENT WITH TIME STRUCTURE FOR ATTENDANT OPERATOR TRADE

### Block – I

Duration- 12 Months (52 weeks)

**Institute Level Training: -**

Sl. No.	Practical Duration: - 830 hrs.	Theory Duration: - 510 hrs.
1.	<p>Importance of trade training, List of tools &amp; Machinery used in the trade.</p> <p><b>SAFETY:</b> Demonstration about PPE'S, Safety Equipment, First aid box Health &amp; Safety: Introduction to safety equipment and their uses. Introduction of first aid, operation of Electrical mains.</p> <p><b>Occupational Safety &amp; Health</b> <b>Importance of housekeeping &amp; good shop floor practices.</b> Health, Safety and Environment guidelines, legislations &amp; regulations as applicable. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Basic safety introduction, Personal protective Equipment's(PPE):- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message. Preventive measures for electrical accidents &amp; steps to be taken in such accidents. Use of Fire extinguishers.</p>	<p><b>SAFETY:</b> Introduction &amp; Importance of safety, General precautions about safety. PPE'S Used in chemical industries. Safety slogan. First aid in industry &amp; Workshop. Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures.</p> <p><b>Soft Skills: its importance and Job area after completion of training.</b> Introduction of First aid. Operation of electrical mains. Introduction of PPEs.</p> <p>Introduction to 5S concept &amp; its application. Response to emergencies e.g.; power failure, fire, and system failure.</p> <p>Fire precautions-causes and types of fires, precautions against outbreak of fire. Fire Extinguishers-types and use.</p>
2.	<p><b>FITTING:</b></p> <p>Filing flat surface and Checking flatness and squareness using engineer's Try square.</p>	<p><b>BASIC FITTING:</b></p> <p>Description, construction and uses of different hand tools such as Files, Chisels, Hacksaw &amp; Hammer etc. Description, construction and uses of different marking tools such as steel rule, caliper, punches, v-block, scribing block etc.</p>

3.	Filing four edges, Checking all dimension with outside caliper and steel rule. Marking of Parallel lines, curve lines using Dot Punch.	<b>JOB HOLDING DEVICES:</b> Description, construction and uses of different job holding devices. Such as vice, V' Block.
4.	Making a job on step fitting (Male & female). Marking out the position of holes for drilling. Use of center drill for drilling operations.	Description, construction, calculation and uses of different Linear Measuring Instruments - Vernier Caliper, Vernier Depth gauge, Height gauge, Micrometer outside, Bevel protector.
5.	Drilling Practice, Reaming Practice, Countersinking & Counter Boring Practice,	Drilling ,Reaming and Threading : Nomenclature and uses of Drill, Reamer, and Thread
6.	Tapping and Dying of BSW OR Metric thread.	Description, nomenclature and uses of different types of threads – metric, BSW, BSF, and BSP etc. Calculation of tap drill size.
7.	<b>GAS WELDING:</b> Demonstration about safety equipments & general precautions in welding workshop.	<b>SAFETY:</b> Safety & General precautions observed in welding workshop. Importance of Welding in maintenance of chemical plant and equipment. Welding terms and their definition. Types of welding
8.	Nut bolting over pipe flange. Riveting and seaming practice on metal sheet.	<b>METAL JOINING METHOD :</b> General introduction about Mechanical method (Riveting, Nut bolting, Seaming etc). Thermal methods (Soldering, Brazing & Welding)
9.	Demonstration about basic welding  (Arc welding and gas welding )          Edge joint with and without filler rod.	<b>GAS WELDING:</b>  Principal of Gas Welding. Safety precautions before, after & during Gas Welding. Common Gases used in Welding.  <b>OXY-ACETYLENE WELDING:</b>  Equipment's such as Oxygen cylinder, Acetylene cylinder, cylinder trolley, regulator, and blow pipe, Hose pipe, Assembling, care & maintenance.

		<p><b>OXY-ACETYLENE FLAME:</b> Types of flame. Uses &amp; Effect of Atmospheric oxidation</p>
10.	<p><b>PHYSICS LAB:</b></p> <p>Determination of acceleration due to gravity by simple pendulum To study law of parallelogram of forces with the help of mechanical board.</p> <p>Determination of coefficient of static friction by inclined plane. Determination of mechanical advantage velocity ratio and % efficiency of Screw jack.</p>	<p>Introduction to Physics, Measurement with Veneer caliper, Micrometer. Scalar and Vector quantities, their representation, resultant. Triangle and parallelogram laws of forces.</p> <p>Newton's laws of motion, Inertia, force, momentum, types of force. Friction- definition, unit, types of friction, laws of friction, advantages and disadvantages of friction</p>
11.	<p>Determination of Young's Modulus by Searle's apparatus</p> <p>To study Ohm's law about current and voltage. To study electric cell using series and parallel connections</p>	<p><b>ELASTICITY:</b> Stress, strain, elastic limit, Hooke's law. Types of modules of elasticity, work done in a stretching wire, determination of Young's modulus</p> <p><b>CURRENT ELECTRICITY:</b> Ohm's law, series &amp; parallel connections, specific resistance, Kirchoff's law</p>
12.	<p>Verification of faraday's First law of electrolysis. Determination of Mechanical equivalent of heat using electrical method.</p> <p>Determination of coefficient of expansion of Solid. Determination of coefficient of expansion of liquid. Determination of coefficient of Thermal Conductivity of metal rod</p>	<p><b>ELECTROLYSIS:</b> Faraday's laws of electrolysis. Thermodynamics- first law of thermodynamics, mechanical equivalent of heat, 'J' by electrical method. Modes of heat transfer, determination of thermal conductivity. Temperature &amp; its measurement, expansion of solid, liquid and gases</p>

13.	<b>CHEMISTRY LAB:</b> Separation of mixture by simple Distillation. Volumetric Analysis-Preparation of Standard Solutions	Introduction of Chemistry, branches of chemistry, importance of chemistry, Safety precautions to be taken in Chemistry Laboratory, different equipment and apparatus used in Laboratory
14.	Volumetric Analysis-1: Alkalimetric Titration. Volumetric Analysis-2: Acidimetric Titration	Atom, molecule, Element, compound, mixture, Physical change, chemical change, Acids, bases, salts-their properties. Molecular weight, equivalent weight, atomic weight, Normality, molarity.
15.	To study the allotropic forms of Sulphur. To study the properties of mixture and compound (Fe + S & FeS)	<b>ATOMIC STRUCTURE:</b> Electrons, protons, neutrons. Electronic theory of valence. Classification of elements, Modern periodic law, table, Groups, periods, periodic properties.
16.	To study action of pure and salt water on metals and alloys. To study action of acids and bases on metals and alloys.	<b>WATER:</b> Sources, hard and soft water, causes and removal of hardness, water for industrial purposes. Introduction to Effluent treatment plant (ETP). Corrosion- causes, effects and prevention. Allotropy of hydrogen, carbon, phosphorus and sulphur
17.	Preparation of (a) Soap (b) Copper sulphate  Determination of pH Boiling point measurement of liquid. Melting point Measurement of solid. Determination flash point of given oil sample.	<b>ORGANIC CHEMISTRY:</b> Introduction, purification processes, organic reactions- substitution, addition, Elimination, rearrangement reactions, examples. Nomenclature-Basic rules for Common name & IUPAC name system for alkanes, alkenes & alkynes, their examples.  Definition of pH, pH scale, measurement of pH. Conductivity, conductivity meter
18.	<b>SAFETY IN CHEMICAL PLANT:</b> Introduction to safety equipment and their uses in chemical plant. Identify and select appropriate protective equipment.	Importance of safety in chemical plant. Accident- causes and effects of accident, prevention of accidents. Personal protective equipment (PPE) in chemical plants.



19.	Read and obtain relevant details from Material Safety Data sheet (MSDS) for a chemical.	Different terms such as Hazard, risk, LEL, UEL TWA, STEL, flash point, fire point, auto ignition temperature. Introduction to occupational health hazard. First aid, material safety data sheet (MSDS). Importance of Housekeeping in chemical industries, Introductory knowledge of ISO-9001(QMS), 14001(EMS) & 18001(OHSMS), Concept of 5'S.
20.	Identify and use of fire extinguisher.	Fire and fire prevention-Definition of fire, chemistry of fire, fire triangle, classification of fire, causes of fire in chemical industries. Fire detection, firefighting system-hydrants, nozzle and hose pipes, water monitors, and automatic sprinklers. Different types of fire extinguisher.
21.	<p><b>INSTRUMENTATION:</b></p> <p>To connect the bourdon tube(C-type) pressure gauge and measure pressure. To connect the capsule type pressure gauge and measure pressure.</p> <p>To measure the temperature using mercury in glass thermometer. To measure the temperature using bi-metallic thermometer. To measure the temperature using R.T.D. thermometer PT100. To study the principle of Thermocouple.</p>	<p><b>INTRODUCTION TO INSTRUMENTATION:</b></p> <p><b>PRESSURE:</b> Definition, units, conversion of units. Classification of pressure measuring instruments-bourdon type, capsule type, and helical type bellows type, diaphragm type pressure gauges.</p> <p><b>TEMPERATURE:</b> Definition, units, conversion of units. Classification of temperature measuring instruments-Mercury in glass thermometer, Bimetallic thermometer, RTD thermometer(PT-100), Thermocouple etc.</p>
22.	<p>To connect the Orifice flow meter with the water pipeline and take readings. To connect venturi flow meter and rota meter, magnetic flow meter in the same water pipeline and compare readings. Find out coefficient of discharge for orifice meter and venturi meter Flow measurement of solid by solid flow meter.</p>	<p><b>FLOW MEASUREMENT:</b> Classification of flow measuring instruments-orifice, venturi, Rota meter, pitot tube, turbine type flow meter, magnetic flow meter ,solid flow meter</p>

23.	<p>To connect the Sight glass level indicator and take readings.</p> <p>To connect the Air purge level indicator and take readings.</p> <p>To study and connect the capacitance type level indicator.</p>	<p><b>LEVEL MEASUREMENT:</b></p> <p>Classification of level measuring instruments-simple float type level indicator, sight glass level indicator, air purge level indicator, capacitance type level indicator.</p>
24.	<p>Measurement of specific gravity of different liquids by using hydrometer</p>	<p><b>SPECIFIC GRAVITY:</b></p> <p>Definition and measurement of specific gravity. Working principle of Hydrometer. Construction and working of final control element(Control valve)</p>
25.	<p><b>MAINTENANCE FITTER:</b></p> <p>Cutting and threading of metal pipe.</p>	<p><b>Introduction to maintenance.</b></p> <p>Types of maintenance-preventive, breakdown, predictive maintenance. Standard pipe threads, Nominal diameter, wall thickness, schedule number, tubing's, taps and dies for pipe threads.</p>
26.	<p>Demonstrate, use of tee, elbow, union, reducer and valves to fit a pipeline as per drawing.</p>	<p><b>PIPES &amp; PIPE FITTINGS:</b></p> <p>Different types of pipe joints- flanged and threaded. Straight connectors, bends or elbows, tees, screwed fittings, coupling,, flanges, bush and collar, plug, stop cock. Binding material, tools for fitting.</p>

27.		<b>THERMAL INSULATION:</b> Lagging of utilities lines in chemical industries. Types and uses of lagging materials. Properties of lagging materials.
28.	Gasket cutting as per size of given flange diameter.	<b>GASKET:</b> Materials for particular applications-cork sheet, oil-proof paper, asbestos, copper, PTFE, rubber, graphite.
29.	Study and use of appropriate locking devices- Lock nut, castle nut, sawn nut, locking pin, spring lock washer.	<b>LOCKING DEVICE :</b> Use of correct material and locking devices- Lock nut, castle nut, sawn nut, locking pin, spring lock washer. <b>BEARINGS:</b> Types, construction and uses of bearings such as ball, roller, bush, etc. their care and maintenance. <b>GEARS:</b> Types of gears-spur gear, helical gear, bevel, their uses, care
30.	Dismantle, clean and assemble gate valve, ball valve, plug valve , butterfly valve , globe valve, needle valve, and check valves (NRVs), diaphragm valve ,stop cock, safety valve, pressure reducing valve, etc.	<b>VALVES :</b> Construction, working and uses of various types of valves. Dismantling and assembling of valves. Knowledge about the maintenance of valves. Selecting appropriate type of valve.
31.	To study Head v/s Capacity curve of by operating i) Centrifugal pump, ii) Reciprocating pump iii) Gear pump.  To Operate of metering pump and screw pump	<b>PUMPS:</b> Classification of pumps. Construction, working principle, uses of different types of pumps. Prevention of leakages around moving parts-stuffing box and mechanical seal. Troubleshooting in pumps. Starting procedure and stopping procedure for centrifugal pump. Characteristic curves of pumps-the plot of actual head, total power consumption, and efficiency vs. volumetric flow rate. Flow of incompressible fluids in pipes.
32.	To determine the pressure drop due to friction as fluid flows through a pipe and verify the effect of pipe roughness on friction.  To determine the resistance offered by fitting and valve and express them in terms	Fans, blowers, and compressors-construction, working principle and uses of fans, bowers and compressors.

	of pipe diameter and velocity head.	
33.	<p><b>Unit Operation</b></p> <p>To determine of viscosity of a liquid by red wood viscometer To determine Reynolds's number and hence the type of flow either laminar or turbulent.</p>	<p>Role of attendant operator in chemical plant. Introduction to Unit Operations and Unit processes, their meanings. Features of unit Operations.</p> <p><b>FLOW OF FLUID:</b> Definition of fluid, ideal fluid, real fluid, compressible fluid, incompressible fluid. Properties of fluid-viscosity, mass density, surface tension. Manometer, Reynolds's Number, Equation of continuity, Bernoulli's theorem.</p>
34.		<p><b>FLOW MEASURING DEVICES:</b> Working and application of Orifice meter, venturi meter, Rota meter, pitot tube, flow nozzle.</p> <p><b>UNIT PROCESS:</b> Difference between Unit operations &amp; Unit Processes. Important chemical processes. Terms related to Unit processes-Raw material, finished product, by-product, conversion, yield, batch process, continuous process. Flow sheet- Types of flow sheet, Process block diagram (PBD), process flow diagram (PFD), PID. Importance of different symbols of unit operations and its use.</p>
35.		<p>Skin friction, pressure drop due to friction in a pipe for laminar and turbulent flow, friction loss from sudden enlargement, sudden contraction, friction losses in pipe fittings and valves. Equivalent length of a fitting</p> <p><b>MANUFACTURING PROCESS OF SULPHURIC ACID BY CONTACT PROCESS</b></p> <p>Raw materials, chemical reactions, process description, flow sheet, uses.</p>

36.		<p><b>HEAT TRANSFER:</b></p> <p>Mechanism of Heat Transfer in solid, liquid and gases and their application in industries, thermal conductivity, Fourier's law, and resistances in series, plane and round surfaces. Heat transfer coefficient (h) and overall heat transfer coefficient (U) Heat transfer equipment, its classification, Heat exchangers, coolers, condenser and chillers. Double pipe heat exchanger, co-current, counter-current flow pattern, Shell and tube heat exchanger-its types, applications in industries, Plate type heat exchanger</p> <p><b>MANUFACTURING PROCESS OF SODA ASH:</b></p> <p>Raw materials, chemical reactions, process description, flow sheet, uses.</p> <p><b>Manufacturing process of Caustic soda</b> - raw materials, chemical reactions, process description, flow sheet, uses</p>
37.		<p><b>EVAPORATION:</b></p> <p>Definition, classification of evaporators, Capacity, steam economy of evaporators, Multiple effect evaporation, methods of feeding in multiple effect evaporation,</p> <p><b>Boiler</b> : types of boilers, dry and wet steam, Boiler mountings and accessories</p> <p><b>Steam Trap:</b></p> <p>Types, Construction and uses</p> <p><b>Manufacturing process of ammonia:</b></p> <p>Raw materials, chemical reactions, process description, flow sheet, uses</p>
38.		<p><b>Effluent Treatment Plant-</b> Introduction, different stages used in ETP. bacterial treatment</p> <p>Pollution control equipment such as bag filter, electrostatic precipitators, Water</p>

		scrubber, Reverse osmosis, cyclone separator
39.	Separation of binary mixture by distillation column.	<p><b>DISTILLATION:</b>  Concept of distillation, boiling point diagrams, vapour-liquid equilibrium, and equilibrium curves. Raoult's law, Henry's law, relative volatility, constant boiling mixtures- minimum &amp; maximum azeotropes,</p> <p><b>METHODS OF DISTILLATION:</b>  Flash differential, rectification and azeotropic, extractive, vacuum, steam distillation. Reflux ratio: minimum, total, optimum, importance of reflux ratio. Types of distillation column. Column internals. Types of trays/plates.</p> <p><b>Introduction to PLC system and DCS system</b></p>
40.		<p><b>TYPES OF PRESSURE VESSELS:</b>  Common terms related to pressure vessels- ASME, API, design pressure, design temperature, operating conditions and hydrostatic test. Corrosion allowance. Material of construction. Different types of storage vessels-Storage of non-volatile, volatile liquids, storage of gases. Fixed or cone roof tanks, Floating roof tanks, cone roof with floating pan. Color coding of piping in industry.</p>
41.	Study of distillation of crude oil (petroleum) & its product by simulation or hardware	<p>Manufacturing process of Nitric acid by ammonia oxidation process.</p> <p>Petroleum and petroleum refining of crude oil, its origin, classification, products from refining of crude oil.</p>

42.	Operation of mixer settler and spray extraction column.	<p><b>SOLVENT EXTRACTION:</b> Introduction, definition, choice of solvent, distribution coefficient. Equipments used for extraction, Packed and perforated plate towers, application of extractions.</p> <p><b>LEACHING:</b> Application and different types of equipment uses for leaching oil extraction from oil seeds.</p>
43.	<p>Flooding velocity experiment using a packed glass column</p> <p>Operation of batch type tank crystallizer</p>	<p><b>ABSORPTION:</b> Introduction, equipment's used for absorption –columns, factors affecting rate of absorption, tower packing, flooding and flooding velocity.</p> <p><b>ADSORPTION:</b> Theory, adsorbents and applications of adsorption.</p> <p><b>CRYSTALLIZATION:</b> Introduction, concepts of solubility &amp; effect of temperature on solubility, crystallization, methods of super-saturation, Different types of crystallizers &amp; their application in industries.</p>
44.	<p>Operation of</p> <p>i) Plate and frame filter press</p> <p>ii) Rotary drum vacuum filter.</p>	<p><b>FILTRATION:</b> Principles of filtration, types of filtrations such as atmospheric, pressure, vacuum and their specific applications. Rate of filtration Classification, construction &amp; working of different types of filters used in industries such as plate and frame Filter Press, rotary drum vacuum filter. Construction and Working of Sparkler filter, leaf filter, notch filter</p>

45.	Operation of Top/Bottom driven centrifuge	<p><b>CENTRIFUGATION:</b> Types of centrifuge construction and working</p> <p><b>MANUFACTURING PROCESS OF SUGAR –</b> Raw materials, chemical reactions, process description, flow sheet, uses.</p> <p><b>MANUFACTURING PROCESS OF UREA:</b>  By synthesis gas - raw materials, chemical reactions, process description, flow sheet, uses.</p>
46.	<p>Finding rate of drying by using tray dryer</p> <p>Study and operate ribbon bender &amp; sigma mixer</p>	<p><b>DRYING:</b> Theory, equilibrium moisture content, factors controlling constant drying rate , constant rate period, falling rate period factor affecting rate of drying, types of dryers and their uses.</p> <p><b>MIXING:</b> Introduction, classification of mixing equipments and its applications, mixers for mixing solid-solid, solid-liquid, solid-gas</p> <p><b>Fuel:</b> Coal, water gas, producer gas, combustion of fuel.</p>
47.	<p>Operation of Blake jaw crusher, Hammer mill, Ball mill.</p> <p>To carry out sieve analysis with a sieve shaker</p>	<p><b>SIZE REDUCTION:</b> Introduction to crushing &amp; grinding, construction, working and applications of size reduction equipment such as jaw / roller crushers, hammer mill, ball mill.</p> <p><b>SCREENING:</b> Screens, standard screens (Tyler’s standard screen) and its principle. mesh number , Classification of Screening equipment’s such as trammels , vibrating Screens &amp; their industrial applications.</p>



48.	Determination of wet bulb & dry bulb temperature by using Humidification – non humidification method	<p><b>HUMIDIFICATION &amp; REFRIGERATION:</b> Theory of Humidification and different terms related to Humidification. different types of refrigerants and their properties and specific use in industries.</p> <p><b>COOLING TOWER:</b> Types of cooling tower working and operating</p> <p><b>MANUFACTURING PROCESS OF ETHYL ALCOHOL:</b> Raw materials, chemical reactions, process description, flow sheet, uses.</p>
49.	Practical on batch sedimentation and coagulation	<p><b>CONVEYING:</b> Introduction and different types of conveyors.</p> <p><b>SEDIMENTATION &amp; DECANTATION:</b> Various type of thickeners and sedimentation operation equipment</p> <p><b>MANUFACTURING PROCESS OF PULP &amp; PAPER:</b> Raw materials, chemical reactions, process description, flow sheet, and uses.</p> <p><b>Pollution in chemical industry:</b> Sources, types &amp; effect of water pollution Definition of COD, BOD, TDS, TSS, air pollution, Air pollution control Measures : Electrostatic precipitator(ESP), cyclone separator, water scrubber, etc.</p>
50.	Operation of oil ring and water ring vacuum pump	<p><b>PLANT UTILITY:</b> Steam, cooling water, chilled water, brine, instrument air, Nitrogen, vacuum, introduction of boiler, cooling tower, chilling plant, compressor, ejector.</p> <p><b>CHEMICAL REACTOR:</b> Types of reactor, Parts of reactor</p>
51.	<b>Revision &amp; Examination</b>	

**NOTE: - Maximum uses of video demonstration and other it based teaching aids may be adopted to deliver the theoretical knowledge.**

Syllabus for

# **EMPLOYABILITY SKILLS**

**GENERAL INFORMATION**  
**(Employability Skill)**

1. **Name of the subject** : **EMPLOYABILITY SKILLS**
2. **Hours of Instruction** : 110 Hrs.
3. **Examination** : The examination will be held at the end of the training.

4. **Instructor Qualification:**

MBA OR BBA with two years experience OR Graduate in Sociology/ Social Welfare/ Economics with Two years experience OR Graduate/ Diploma with Two years experience and trained in Employability Skills from DGET institutes.

AND

Must have studied English/ Communication Skills and Basic Computer at 12<sup>th</sup> / Diploma level and above.

OR

Existing Social Studies Instructors duly trained in Employability Skills from DGET institutes.

5. **Instructor:**

One full time regular instructor shall be engaged on every 240 numbers of trainees for teaching the subject "Employability Skills". One additional full time regular instructor would be required on increase in every 240 trainees. Wherever the trainees are less than 240 or part thereof, a part-time instructor may be engaged to teach the subject.

## ALLOTMENT OF TIME AND MARKS AMONG THE TOPICS

Sl. No.	Topics	Allotted Hours	Marks Allotted	To be covered in
1.	English Literacy	20 hrs.	9	<b>Block - I</b>
2.	I.T. Literacy	20 hrs.	9	
3.	Communication Skills	15 hrs.	7	
	<b>Sub Total</b>	55	25	
4.	Entrepreneurship Skills	15 hrs.	6	
5.	Productivity	10 hrs.	5	
6.	Occupational safety , health and Environment Education	15 hrs.	6	
7.	Labour Welfare Legislation	05 hrs.	3	
8.	Quality Tools	10 hrs.	5	
	<b>Sub Total</b>	55	25	
	<b>TOTAL</b>	<b>110 hrs.</b>	<b>50</b>	

## Detail of Syllabus

1. English Literacy Hours of Instruction: 20 Hrs. <span style="float: right;">Marks Allotted: 09</span>	
<b>Pronunciation</b>	Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)
<b>Functional Grammar</b>	Transformation of sentences, voice change, Change of tense, spellings.
<b>Reading</b>	Reading and understanding simple sentences about self, work and environment
<b>Writing</b>	Construction of simple sentences Writing simple English
<b>Speaking / Spoken English</b>	Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.
2. I.T. Literacy Hours of Instruction: 20 Hrs. <span style="float: right;">Marks Allotted: 09</span>	
<b>Basics of Computer</b>	Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.
<b>Computer Operating System</b>	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.
<b>Word processing and Worksheet</b>	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
<b>Computer Networking and INTERNET</b>	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.
<b>3. Communication Skills Hour of Instruction: 15 Hrs.</b>	
<b>Allotted: 07</b>	
<b>Introduction to Communication Skills</b>	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.
<b>Listening Skills</b>	Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.
	Triple- A Listening - Attitude, Attention & Adjustment.
	Active Listening Skills.
<b>Motivational Training</b>	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.	
<b>Facing Interviews</b>	Manners, Etiquettes, Dress code for an interview
	Do's & Don'ts for an interview
<b>Behavioral Skills</b>	Problem Solving
	Confidence Building
	Attitude
<b>4. Entrepreneurship Skills Hour of Instruction: 15 Hrs.</b>	
<b>Allotted: 06</b>	
<b>Concept of Entrepreneurship</b>	Entrepreneur - Entrepreneurship - Enterprises:- Conceptual issue
	Entrepreneurship vs. management, Entrepreneurial motivation. Performance & Record, Role & Function of
	Entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business.
<b>Project Preparation &amp; Marketing analysis</b>	Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.
<b>Institutions Support</b>	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.
<b>Investment Procurement</b>	Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.
<b>5. Productivity</b> <b>Hour of Instruction: 10 Hrs.</b> <b>Marks Allotted: 05</b>	
<b>Benefits</b>	Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard. Industry Nation.
<b>Affecting Factors</b>	Skills, Working Aids, Automation, Environment, Motivation How improves or slows down.
<b>Comparison with developed countries</b>	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.
<b>Personal Finance Management</b>	Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.
<b>6. Occupational Safety, Health and Environment Education</b> <b>Hour of Instruction: 15 Hrs.</b> <b>Marks Allotted: 06</b>	
<b>Safety &amp; Health</b>	Introduction to Occupational Safety and Health importance of safety and health at workplace.
<b>Occupational Hazards</b>	Basic Hazards, Chemical Hazards, Vibro acoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention.
<b>Accident &amp; safety</b>	Basic principles for protective equipment. Accident Prevention techniques - control of accidents and safety measures.
<b>First Aid</b>	Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person
<b>Basic Provisions</b>	Idea of basic provision legislation of India. of safety, health, welfare under legislative of India.

<b>Ecosystem</b>	Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.
<b>Pollution</b>	Pollution and pollutants including liquid, gaseous, solid and hazardous waste.
<b>Energy Conservation</b>	Conservation of Energy, re-use and recycle.
<b>Global warming</b>	Global warming, climate change and Ozone layer depletion.
<b>Ground Water</b>	Hydrological cycle, ground and surface water, Conservation and Harvesting of water
<b>Environment</b>	Right attitude towards environment, Maintenance of in-house environment
<b>7. Labour Welfare Legislation</b>	
<b>Hour of Instruction: 05 Hrs. Marks Allotted: 03</b>	
<b>Welfare Acts</b>	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.
<b>8. Quality Tools</b>	
<b>Hour of Instruction: 10 Hrs. Marks Allotted: 05</b>	
<b>Quality Consciousness</b>	Meaning of quality, Quality characteristic.
<b>Quality Circles</b>	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.
<b>Quality Management System</b>	Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.
<b>House Keeping</b>	Purpose of Housekeeping, Practice of good Housekeeping.
<b>Quality Tools</b>	Basic quality tools with a few examples



### Tools & Equipments for Employability Skills:

Sl. No.	Name of the Equipment	Quantity
1	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	10 nos.
2	UPS - 500VA	10 nos.
3	Scanner cum Printer	1 no.
4	Computer Tables	10 nos.
5	Computer Chairs	20 nos.
6	LCD Projector	1 no.
7	White Board 1200mm x 900mm	1 no.

\* **Note:** Above Tools & Equipments not required, if Computer LAB is available in the institute.

Syllabus for

# **ENGINEERING DRAWING**

**GENERAL INFORMATION**  
**(Engineering Drawing)**

1. Name of the Subject : ENGINEERING DRAWING
2. Hours of Instruction : 310 hrs.
3. Instructor Qualification : Degree in Engineering with one year experience  
OR  
Diploma in Engineering with two years experience  
OR  
NCVT / NAC in the Draughtsman (Mechanical/ Civil) with three years experience.
4. Desirable : Craft Instructor Certificate in RoD & A course under NCVT.
5. Instructor:
  - One full time instructor is required for 144 Engineering seats sanctioned in the institute. Additional instructor will be required on increase in every 144 students.
  - For seats less than 144, the instructor may be out sourced/ hired on contract basis.

## Details of syllabus (AOC-P-Dual Mode )

Sl. No.	Topics (Total duration - 310 hrs.)
1.	Engineering Drawing: Introduction and its importance <ul style="list-style-type: none"> <li>- Relationship to other technical drawing types</li> <li>- Conventions</li> <li>- Viewing of engineering drawing sheets.</li> <li>- Method of Folding of printed Drawing Sheet as per BIS SP:46-2003</li> </ul>
2.	Drawing Instruments : their Standard and uses <ul style="list-style-type: none"> <li>- 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.</li> </ul>
3.	Lines : <ul style="list-style-type: none"> <li>- Definition, types and applications in Drawing as per BIS SP:46-2003</li> <li>- Classification of lines (Hidden, centre, construction, Extension, Dimension, Section)</li> <li>- Drawing lines of given length (Straight, curved)</li> <li>- Drawing of parallel lines, perpendicular line</li> <li>- Methods of Division of line segment</li> </ul>
4.	Drawing of Geometrical Figures: Definition, nomenclature and practice of - Angle: Measurement and its types, method of bisecting. <ul style="list-style-type: none"> <li>- Triangle -different types</li> <li>- Rectangle, Square, Rhombus, Parallelogram.</li> <li>- Circle and its elements.</li> </ul>
5.	Lettering and Numbering as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
6.	Dimensioning: <ul style="list-style-type: none"> <li>- Definition, types and methods of dimensioning (functional, nonfunctional and auxiliary)</li> <li>- Types of arrowhead</li> <li>- Leader Line with text</li> </ul>
7.	Free hand drawing of <ul style="list-style-type: none"> <li>- Lines, polygons, ellipse, etc.</li> <li>- geometrical figures and blocks with dimension</li> <li>- Transferring measurement from the given object to the free hand sketches.</li> </ul>
8.	Sizes and Layout of Drawing Sheets <ul style="list-style-type: none"> <li>- Basic principle of Sheet Size</li> <li>- Designation of sizes</li> <li>- Selection of sizes</li> <li>- Title Block, its position and content</li> <li>- Borders and Frames (Orientation marks and graduations)</li> <li>- Grid Reference</li> <li>- Item Reference on Drawing Sheet (Item List)</li> </ul>
9.	Method of presentation of Engineering Drawing <ul style="list-style-type: none"> <li>- Pictorial View</li> <li>- Orthogonal View</li> <li>- Isometric view</li> </ul>
10.	Symbolic Representation (as per BIS SP:46-2003) of :

	Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings
11.	Construction of Scales and diagonal scale
12.	Practice of Lettering and Title Block
13.	Dimensioning practice: - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance. - Text of dimension of repeated features, equidistance elements, circumferential objects.
14.	Construction of Geometrical Drawing Figures: - Different Polygons and their values of included angles. Inscribed and Circumscribed polygons. - Conic Sections (Ellipse & Parabola)
15.	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.
16.	Free Hand sketch of hand tools and measuring tools used in respective trades.
17.	Projections: - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1 <sup>st</sup> angle and 3 <sup>rd</sup> angle projection as per IS specification.
18.	Drawing of Orthographic projection from isometric/3D view of blocks
19.	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
20.	Drawing details of two simple mating blocks and assembled view.
21.	- 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
22.	- ISI symbols of Generator, Voltmeter, Ammeter, and Watt-meter. Resister, inductor, Capacitor, Transformer, AC & DC motors. etc. Drawing of pressure control process line.
23.	- Drawing sketches of different types of valves, such as gate valve, plug valve, ball valve, globe valve, needle valve, diaphragm valve check valves (NRVs), Safety valve, pressure reducing valve, etc.
24.	- Drawing of different types locking devices such as double nut, castle nut, pin etc. - Drawings of different types of keys.-Types of couplings such as muff coupling, Half lap coupling, Flange coupling
25.	- Free hand sketches and 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.
26.	- Free hand sketches of Belt conveyer, Screw conveyer, Bucket elevator
27.	- Orthogonal views of keys of different types

28.	- Drawing of pressure, Level, flow and temperature control system.
29.	- Exercises on blue print reading related to the trade.
30.	-Free hand sketch Freehand sketches of crushers, ball mill, hammer mill and centrifuges
31.	- Freehand sketches of steam jet ejector, steam trap
32.	- Diagram of distillation column with all accessories - Freehand sketches of process instrument-such as temperature indicator, level indicator, LIC,TIC,PI,PIC, FI,FIC
33.	- Free Hand Sketches of Process Flow Sheets of Manufacturing-Ammonia and Urea
34.	- Solution of NCVT test. - Simple exercises related to trade related symbols. - Basic electrical and electronic symbols
35.	- Study of drawing & Estimation of materials.
36.	- Solution of NCVT test papers.
37.	<b>Revision</b>
38.	<b>Examination</b>

## **LIST OF TOOLS & EQUIPMENTS**

<b>Sl. No.</b>	<b>NAME OF TOOLS / EQUIPMENTS</b>	<b>QUANTITY (Nos)</b>
1.	Drawing Board	16
2.	Models : Solid & cut section	as required
3.	Table for trainees	16
4.	Stool for trainees	16
5.	Cupboard (big)	01
6.	White Board (size: 8ft. x 4ft.)	01
7.	Trainer's Table	01
8.	Trainer's Chair	01

Syllabus for

# **Workshop Science & Calculation**



**GENERAL INFORMATION**  
**(Workshop Science & Calculation)**

1. Name of the subject : WORKSHOP CALCULATION & SCIENCE
2. Hours of Instruction : 220 hrs.
3. Examination : The examination for the subject will be held at the end of training.
4. Instructor Qualification : Degree in Engineering with one year experience  
OR  
Diploma in Engineering with two years experience
5. Desirable : Craft Instructor Certificate in RoD & A course under NCVT.

6. Instructor:

One full time instructor is required for 144 Engineering seats sanctioned in the institute. Additional instructor will be required on increase in every 144 students.

For seats less than 144, the instructor may be out sourced/ hired on contract basis.

## SYLLABUS FOR WORKSHOP SCIENCE AND CALCULATION

(Total duration – 220 hrs.)

Topic No	Workshop Calculation	Workshop Science
1.	<b>Unit:</b> Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	<b>Material Science :</b> properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.
2.	<b>Fractions:</b> 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.	<b>Mass ,Weight and Density :</b> Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.
3.	<b>Square Root:</b> Square and Square Root, method of finding out square roots, Simple problem using calculator.	<b>Speed and Velocity:</b> Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.
4.	<b>Ratio &amp; Proportion :</b> Simple calculation on related problems.	<b>Work, Power and Energy:</b> work, unit of work, power, unit of power, Horse power of engines,
5.	<b>Percentage:</b> Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	Mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.
6.	<b>Algebra:</b> Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	<b>Heat &amp; Temperature:</b> 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.
7.	<b>Mensuration :</b> 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.	<b>Basic Electricity:</b> Introduction, use of electricity, how electricity is produced, Types of current: AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy.
8.	<b>Trigonometry:</b> Trigonometrical ratios, measurement of angles. Trigonometric tables	<b>Levers and Simple Machines:</b> Levers and its types. Simple Machines, Effort and Load, Mechanical Advantage,

		Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.
9.	- <b>Density and specific gravity.</b> Archimedes's principle, hydrometers. Centre of gravity and equilibrium condition.	- <b>Definition</b> -viscosity, flashpoint, fire point, flash points of standard lubricating oils, octane number
10.	- Pressure, temperature, Boyle's law, Charle's law, Equation of perfect gas. Calculations. Definition-Torque, compression ratio, IHP, BHP, Mechanical efficiency	- Newton's laws of motion, unit of force, find out resultant force, space and vector diagram, representation of force, parallel force, couple, parallelogram law of forces, condition of equilibrium, kind of equilibrium, some examples of equilibrium in daily life, Lami's theorem.
11.	<b>Heat and temperature</b> , 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	- Advantages & Disadvantages of friction, Limiting friction, Laws of limiting friction, Coefficient of friction, angle of friction, Inclined plane, Force of friction
12.	<b>Moment and lever</b> - Moments, unit, arm of couple. Principle of Moment, moment of couple, lever, torque. Centre of Gravity, (C.G. Of square, rectangle, triangle, circle, semicircle, cone) & its calculations	-Introduction, Different types of stresses, Hooke's law, Young's modulus or modulus of elasticity, yield point, factor of safety, stress strain graph, Modulus of rigidity, Poisson's ratio, Calculation (i.e. stress, strain, young modulus, factor of safety)
13.	<b>Flow of fluids:</b> Equation of continuity, Bernoulli's theorem, flow measurement by orifice meter, venturi meter, Rota meter, U-tube manometer.	<b>Transmission of Motion and Power</b> - Belt and pulley system, calculation of find out length of belt, slip of belt, RPM, Dia. Of pulley, circular & dimetral pitch of gear, distance between centre of two gears
14.	<b>Further Mensuration</b> :-Volumes of frustums include conical frustums. <b>Graph</b> - Basics, abscissa, co-ordinate etc. $Y = mX$ and $Y = mX + C$ graph	<b>DEFINITION:</b> Torque, compression ratio, IHP, BHP, Mechanical efficiency, FHP, Swept volume, piston speed (for reciprocating machine) & Calculations
15.	- Simple Problems on Profit & Loss.	<b>Bending moment (BM)</b> , shearing force, <b>Beam</b> - simply supported beam, simply supported beam with distributed load, cantilever with point load at the free end, cantilever with distributed load and its calculation.
16.		Latent heat, sensible heat, saturated steam,

	Simple and compound interest.	wet steam, superheated steam. Reynolds's number, calculation of Reynolds's number at different velocities
--	-------------------------------	---

## **BLOCK – II**

DURATION: 09 Months (39 Weeks)

### **Industry level training**

#### **BROAD LEARNING TO BE COVERED IN INDUSTRY FOR ATTENDANT OPERATOR (CHEMICAL PLANT) TRADE**

1. Safety and best practices /Basic Industrial Culture ( 5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Basic chemical process plant machineries operations
4. Repair & Maintenance work in chemical industry
5. Inspection & testing of different unit operation equipments in industry

**Actual training will depend on the existing facilities available in the establishments.**

The candidate should be competent to execute following operation/ skills after completion of the industrial training: -

#### **1) SAFETY IN CHEMICAL PLANT:**

- Introduction to safety equipment and their uses in chemical plant.
- Identify and select appropriate protective equipments (for Face,\ Eye, Respiratory, hearing protection)
- Read and obtain relevant details from MSDS for a chemical.
- Identification and Use of different types of fire extinguishers.( Class: A,B,C,D,E)
- To operation of Fire hydrant system.
- To operate fire alarm system with sprinkler system.
- To operate gas detector with air tight chamber.
- \* **Theory** related to above safety equipments and fire fighting equipments used in chemical plant.

#### **2) Instrumentation**

- To identify different parts and operate the final control element (control valve)
- \* **Theory** related to different control valves used in industry.

#### **3) Maintenance Fitter**

- Operation and maintenance of Multi-stage compressor
- Identify of different types bearings and removing and fitting bearings such as ball Bearing, roller bearing, bush bearing etc.
- Dismantle, clean and assemble of different types of gears such as spur gear, Helical gear, bevel gear etc.
- Use and maintenance of lagging materials such as glass wool, asbestos, thermocol.
- Dismantle, clean and assemble a centrifugal pump, multistage centrifugal pump, (Piston/plunger pump), gear pump, diaphragm pump, metering pump and screw pump. Checking the alignment of shafts and coupling.
- Changing gland packing in stuffing box and changing of mechanical seal in different types of pumps.
- \***Theory** of operation and maintenance of compressors, Bearings, Pumps, alignment of pump with motor, mechanical seals, etc.

#### 4) Unit Operations

- To determine of viscosity of a liquid by digital viscometer
- To operate double pipe heat exchanger, shell and tube heat exchanger, (1-1 /1-2 /2-4 ), Plate heat exchanger etc. and finding heat transfer rate for each heat exchanger.
- To conduct hydraulic test for shell and tube heat exchanger for checking leakage in tube bundle.
- To operate standard single effect standard vertical tube evaporator and triple /multi-effect effect evaporator to obtain steam economy and capacity of evaporator
- Operation of Sparkler filter, Leaf filter, Notch filter
- Operation of Rotary drier and spray drier
- Operation of cooling towers such as natural draft/ forced draft /induced draft cooling tower
- Operation of belt Conveyor , screw conveyor, bucket elevator
- Study of chemical reactors and storage vessels and boilers
- Separation of binary liquid mixture by distillation using packed tower/bubble cap tray /sieve tray distillation column.
- Distillation of crude oil (Petroleum) &its product in plant/ study of distillation of crude oil (Petroleum) simulator
- Demonstration of PLC and DCS systems.
- Study of APCM (Air pollution control Measures) ESP /cyclone separator /water scrubber.
- Study of Effluent Treatment Plant (ETP) and different process while treatment to effluents / waste water in ETP.
  
- **\*Theory** related to above each unit operation and each equipment before conducting practicals /skill in industry.

#### NOTE: -

1. In addition to the above mentioned skills/ operations, industry may impart training on any other skills/ operations related to the trade.
  
2. Assignment should be planned so that the trainees may spend 20% of the total time of production type of work for developing their skill and confidence about manufacturing which will help ever in self- employment, if found necessary in the future.

## **BLOCK – III**

**DURATION: 3 Months (13 Weeks)**

### **Institute level training**

**For last three months candidates will be engaged in following works: -**

1. Revision of theoretical components covered during Block – I.
2. Practical practice and report submission
3. Preparing candidate to face interview, preparation of bio-data, awareness about different jobs in the related field and grooming to be an entrepreneur.
4. Self study and final AITT examination

#### **Note:-**

1. The training may be conducted in Block mode i.e. few months in ITI & few in Industry.
2. The training may be conducted in flexible mode i.e. few days of a week in ITI & few days in Industry.
3. Nine months industrial training is mandatory.
4. Last three months of training in ITI is mandatory.
5. No admission of trainees without signing MOU with industry by the Institute (ITI).
6. To sign MOU with ITI, industry must ensure the training facility should be available to impart different skill sets as indicated in Block-II. At least 75% of total skill set in Block-II for AOCIP to be covered in industry.
7. If the industry ensures delivery of skill training as per Sl. 6 then 2nd MOU is not necessary.
8. However, Industry should ensure 100% skill training indicated in Block-II & necessary arrangement to be made to cover training on rest skill set (beyond the % indicated in sl.6) in collaboration with any other related industries. (The same will be part of guidelines in MoU.)

**TRADE: AOCP (Dual mode)****LIST OF TOOLS & EQUIPMENTS FOR 16 TRAINEES**

<b>A. Workshop /Lab Infrastructure (Tools, Equipments, Machineries, etc.)</b>		
<b>Sr. No.</b>	<b>Name of Item</b>	<b>Quantity</b>
	<b>Mechanical Fitter</b>	
1	Safety shoes ( Regular size )	17 Nos
2	Safety Goggles	17 Nos
3	Safety hand gloves leather ( Regular size )	17 Nos
4	Ear plug	17 Nos
5	Helmet	17 Nos
6	Fire Extinguishers ( CO2 )	1 No
7	Fire Extinguishers ( Dry Chemical powder )	1 No
8	Sand bucket	2Nos
9	Fire blanket	2Nos
10	Steel Rule - 300 mm, Graduated both in Metric and English Unit	6 Nos
11	Try Square - 150 mm	6 Nos
12	Caliper - Inside Spring - 150 mm	6 Nos
13	Caliper - Outside Spring - 150 mm	6 Nos
14	Divider Spring Type - 150 mm	6 Nos
15	Punch Centre - Diameter - 10 mm and Length - 100 mm	6 Nos
16	Punch Prick - 100 mm	6 Nos
17	Letter and Number Punch - 5mm	1 No
18	Scriber- Straight- 150 mm	6 Nos
19	Hacksaw Frame - Fixed - 300 mm	6 Nos
20	File - Flat - Bastard - 250 mm	6 Nos
21	File - Flat - Second Cut - 250 mm	6 Nos
22	File - Flat - Smooth - 250 mm	6 Nos
23	File - Half Round - Second Cut - 250 mm	6 Nos
24	File - Round - Smooth - 250 mm	6 Nos
25	File - Triangular - Smooth - 150 mm	6 Nos
26	File - Square - Second Cut - 200 mm	6 Nos
27	Chisel - Cold - Cross Cut - 9 mm X 150 mm	6 Nos



28	Chisel - Cold - Flat - 20 mm X 150 mm	6 Nos
29	Hammer - Ball Pein - 250 grams	6 Nos
30	Hammer - Ball Pein - 500 grams	6 Nos
31	Screw Driver - 9 X 300 mm	4 Nos
32	Drill Twist Set - Straight Shank - 3 mm to 13 mm by 0.5 mm	1 No
33	Drill Twist Set - Tapper shank 12 to 25 mm	1 No
34	Double Ended Spanner set Metric 6*7 to 30*32	1 set
35	Pipe wrench 14"	1 set
36	Combination Plier	2 Nos
37	Tap set -M 8, M10 M12	2 Nos
38	Solid die 10/12 mm with die stock	2 Nos
39	Gauge Screw Pitch - Metric -0.25 to 6 mm	1 No
40	Wire Gauge - Metric	1 No
41	Allen Key Set - Hexagonal - 1 - 12 mm, set of 12 Keys	1 No
42	Vernier Calliper - 0 - 200 mm with least count 0.02mm	1 No
43	Vernier Height Gauge - 0 - 300 mm with least count = 0.02 mm	1 No
44	Universal Dial Test Indicator - Plunger Type - Range 0 - 10 mm, Graduation 0.01 mm & 0.001mm Reading 0 - 10 with Revolution Counter complete with Clamping Devices and Magnetic Stand	2 Nos
45	Micrometer - Outside - 0 - 25 mm	1 No
46	V Block - 75 x 75 x 50 mm with Clamp (Hardened & Ground)	1 No
47	Bench Vice - 125 mm	6 Nos
48	Anvil - 50 Kg - with stand	1 No
49	Surface Plate - Granite - 450 x 450mm with Stand and Cover	1 No
50	Drilling Machine - Bench Type - 13 mm Motorized with Standard Accessories	1 No
51	Pedestal Grinder - Double Ended - 200 mm	1 No
52	Bearing removing and fitting kit	1 No
53	Gear box	1 No
#54	<b>Welding</b> Gas welding torch with nozzle set(Arc welding set )	1 No
#55	Oxygen Cylinders and Acetylene Cylinder	1 each
#56	Spark Lighter	6 Nos
#57	Oxygen Gas Pressure Regulator Double Stage	1 No
#58	Acetylene Gas pressure Regulator Double Stage	1 No
#59	Rubber Hose - Acetylene, Diameter = 8 mm, Length = 10 meters	1 No

#60	Rubber Hose - Oxygen, Diameter = 8 mm, Length = 10 metres	1 No
#61	Rubber Hose Clips - 1/2 inch	6 Nos
#62	Tong - Flat - 300 mm	4 Nos
#63	cylinder Key	4 Nos
#64	Welding Helmet	2 Nos
65	<b>Physics</b> Instrument for determining 'g' (Simple Pendulum)	1 No
66	Mechanical board for testing triangle and parallelogram of forces including all accessories	2 Nos
67	Inclined plane with pulley, pan, weights etc.	1 No
68	Simple machines - Screw Jack with Accessories	1 No
69	Searle's Apparatus for young's Modulus	2 Nos
70	Calorimeter for determining Joule's mechanical Equivalent of heat by electric method	1 No
71	Apparatus for measurement of co-efficient of expansion(thermal) of solid (pullinger's apparatus)	2 Nos
72	Apparatus for measurement of thermal conductivity of good and bad conductors	1 No
73	<b>Mercury Thermometers :</b>	
	(1) 0 to 110° C	6 Nos
	(2) 0 to 250° C	6 Nos
	(3) 0 to 360 ° C	6 Nos
74	<b>Rheostat</b>	
	(a) Rheostat 25 ohms	2 Nos
	(b) Rheostat 100 ohms	2 Nos
75	Resistance box 0 to 500 ohms	2 Nos
76	Resistance coils (2 ohms, 5 ohms, 10 ohms, 100 ohms)	2 Nos
77	<b>Ammeter</b>	2 Nos
	0 to 1000 mA. (DC)	2 Nos
	0 to 10 Amp. (AC, DC)	2 Nos
78	<b>Voltmeter</b>	2 Nos
	0 to 1 volt (DC)	2 Nos
	0 to 5 volt (DC)	2 Nos
	0 to 10 volt (DC)	2 Nos

79	Battery eliminator	2 Nos
80	Specific Gravity bottle 25 cc	2 Nos
81	Rods with screw at one end for Electrochemical equivalent 1) Carbon 2) Zinc 3) Copper	2 Nos
82	Multi meter (digital)	2 Nos
83	Milli voltmeter 1) 0 - 5mv 2) 0- 500mv	2 Nos
84	Digital Stop Watch 1/10 Second	1 No
85	<b>Chemistry</b> PH Meter Digital	2 Nos
86	Flash point apparatus	1 No
87	Steam generator (copper) Cap. 1000ml	2 Nos
88	Burette clamp	12 Nos
89	Bunsen Burners	8 Nos
90	Tripods Stand	8 Nos
91	Asbestos wire gauge	8 Nos
92	Gauge Wire without asbestos	8 Nos
93	Burettes 25ml borosilicate	8 Nos
94	Pipettes 10ml	8 Nos
95	H.D.P. Distil water bottle	8 Nos
96	Clamp holders	12 Nos
97	Stands with clamps for burette	12 Nos
98	Triangles clay	8 Nos
99	Measuring cylinder 250 ml Glass	8 Nos
100	Measuring cylinder 500 ml Glass/ Plastic	8 Nos
101	Measuring cylinder 1000 ml Glass/ Plastic	8 Nos
102	Volumetric flask 100 ml	8 Nos
103	Volumetric flask 500 ml	8 Nos
104	Volumetric flask 1000 ml	8 Nos
105	Funnels Diameter - 7.5cms	8 Nos
106	Beaker 250ml corning	8 Nos
107	Beaker 500 ml corning	8 Nos
108	Bottles for solutions 1000 ml	6 Nos

109	Bottles for solutions 2000 ml	6 Nos
110	Bottles for solutions 500 ml	6 Nos
111	Conical flask -500 ml	16 Nos
112	Conical flask - 250 ml	16 Nos
113	Evaporating dish - 50 ml	12 Nos
114	Watch Glass - 3" dia	8 Nos
115	Tong - Flat - 300 mm	8 Nos
116	Spatula - 8"	8 Nos
117	Distilled water still 10 lit.	1 No
118	Glass test tubes - 15 ml	50 Nos
119	Round Bottom Distillation flask with side neck 500ml	6 Nos
120	Condenser for distillation lebig 30 cm long	6 Nos
121	Rubber cork of ( 2.5 cm, 3cm) size Various size	10 Nos
122	Rubber Tubing (ID- 5mm) 8 / 10 ml	10 Nos
123	Rubber Bulbs for pipettes	6 Nos
	<b>Instrumentation</b>	
124	Bourdon tube(C-type) pressure gauge	1 No
125	Capsule type pressure gauge	1 No
126	R.T.D. thermometer ,Pt. 100,Bimetallic thermometer , Thermocouple	2 each
127	Venturi meter, orifice meter ,rotameter	1each
128	Capacitance Level indicator	1 No
129	Sight glass level indicator	1 No
130	Hydrometer	1 No
	<b>Unit Operation Lab</b>	
131	Reynolds's Experiment equipment	1 No
132	Cut models of Centrifugal pump and multistage centrifugal pump, Piston pump ,gear pump ,diaphragm pump, screw pump	1 each
133	Venturi-meter, orifice- meter , rotameter test rig	1 No
134	Packed tower of glass for flooding velocity experiment	1 No
135	Centrifugal pump test rig	1 No
136	Gear pump test rig	1 No
137	Reciprocating pump test rig	1 No
138	Apparatus for determine Frictional losses in straight pipe , pipe fitting	1 No
139	Packed distillation tower.	1 No
140	Mixer-settler type extractor	1 No
141	Spray extraction column	1 No

142	Batch type tank crystallizer	1 No
143	Plate and frame filter press	1 No
144	Rotary drum vacuum filter	1 No
145	Bottom /Top driven centrifuge	1 No
146	Blake jaw crusher	1 No
147	Hammer mill	1 No
148	Ball mill	1 No
149	Sieve shaker and sieves	1 No
150	Humidification control equipment with dry and wet bulb Temperature	1 No
151	Different types of pipe fittings	1 No
152	Locking devices Lock nut , Castle nut	1 No
153	Mechanical seal (Different type and different size )	1 set of 10
154	Redwood viscometer /Brook's field viscometer	1 No
155	Various types of valves like, Gate valve ( Rising and non-rising steam ), Plug valve ,Ball Valve, Globe valve, Needle valve , Check valve[NRV- Swing ,Ball, Lift, ],diaphragm valve, , butterfly valve , Safety valve, relief valve, Pressure control valve,(Flanged and Thread End) 2"/4" diameter	1 each
156	Batch sedimentation apparatus	1 No
157	Magnetic flow meter	1 No
158	Solid measurement flow meter	1 No
159	Water ring vacuum pump	1 No
160	Oil ring vacuum pump	1 No

**Note : #** Those additional items are to be provided for the Allied Trade Training where the Welding trade does not exist.

## Format for Internal Assessment

Name & Address of the Assessor :						Year of Enrollment :								
Name & Address of ITI (Govt./Pvt.) :						Date of Assessment :								
Name & Address of the Industry :						Assessment location: Industry / ITI								
Trade Name :			Block:			Duration of the Trade/course:								
Operation/Skill:														
Sl.No	Maximum Marks (Total 100 Marks)		15	5	10	5	10	10	5	10	15	15	Total internal assessment Marks	Result (Y/N)
	Candidate Name	Father's/Mother's Name	Safety consciousness	Workplace hygiene	Attendance/Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA		
1														
2														

## **LIST OF TRADE COMMITTEE MEMBERS**

List of members who have attended the Trade Committee meeting on 20<sup>th</sup> December, 2016 at “St. Joseph’s Industrial Training Institute, Kurla(W) Mumbai” for restructuring of curricula of “**Attendant Operator (Chemical Plant )**” Trade under the Dual Training System (DTS)

<b>Sl. No.</b>	<b>Name &amp; Designation Shri</b>	<b>Organization</b>	<b>Remarks</b>
1.	R. K. Pathak, Director (Training)	DGT, MoSDE, GoI, New Delhi	Member
2.	L. K. Mukherjee, Dy. Director(T)	CSTARI, Kolkata(WB)	Member
3.	R. N. Manna, Training Officer	CSTARI, Kolkata (WB)	Member
4.	Amar G. Prabhu, Principal	St. Joseph’s ITI, Kurla(W), Mumbai	Member
5.	S. D. Ghadigaonkar, Sr. Manager (HRD)	Rashtriya Chemical and Fertilizers Ltd., Chembur, Mumbai	Member
6.	S. R. Shinde, Craft Instructor	Govt. ITI Nagothane, Maharashtra	Member
7.	S. S. Bhadoria, Sr. Instructor	J. K. ITI Nimbihra, Rajasthan	Member
8.	Kamalesh Prajapati, Technical Director	Technology Exchange Services Pvt. Ltd. Ahmedabad, Gujarat	Member
9.	D. K. Sharma, MD	Technology Exchange Services Pvt. Ltd. Ahmedabad ,Gujarat	Member
10.	Nitin Kumar, Sr. Engineer	HPCL Refinery, Mahul , Mumbai	Member
11.	Nitin Tamhane, Director	Toshbro Controls, Ahmedabad, Gujarat	Member
12.	Sunil Wakde, Asst. Director (T)	Advanced Training Institute , Sion, Mumbai	Member
13.	P. C. Bhandari, Principal	J K Institute of Technology, Chittorgarh	Member
14.	Asheesh Kr. Gupta, GM (Production)	J K Cement, Nimbihra, (Rajasthan)	Member
15.	Axit M Raycha, MD	Zenith health Care Ltd., Ahmedabad, Gujarat	Member
16.	Rupesh Shah, Sr. Manager	Masibus Automation, Ahmedabad, Gujarat	Member
17.	Rajendra Mandora, Manager	Nish Automation, Ahmedabad, Gujarat	Member
18.	Sagar Panchal, Executive Project	Mada Limited, Ahmedabad, Gujarat	Member