PROCESS PLANT OPERATOR

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – PRODUCTION & MANUFACTURING

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

PROCESS PLANT OPERATOR

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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1. BACKGROUND

1.1 Apprenticeship Training Scheme under Apprentice Act 1961

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

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

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

1.2 Changes in Industrial Scenario

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

1.3 Reformation

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

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

2. TRAINING SYSTEM

2.1 GENERAL

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

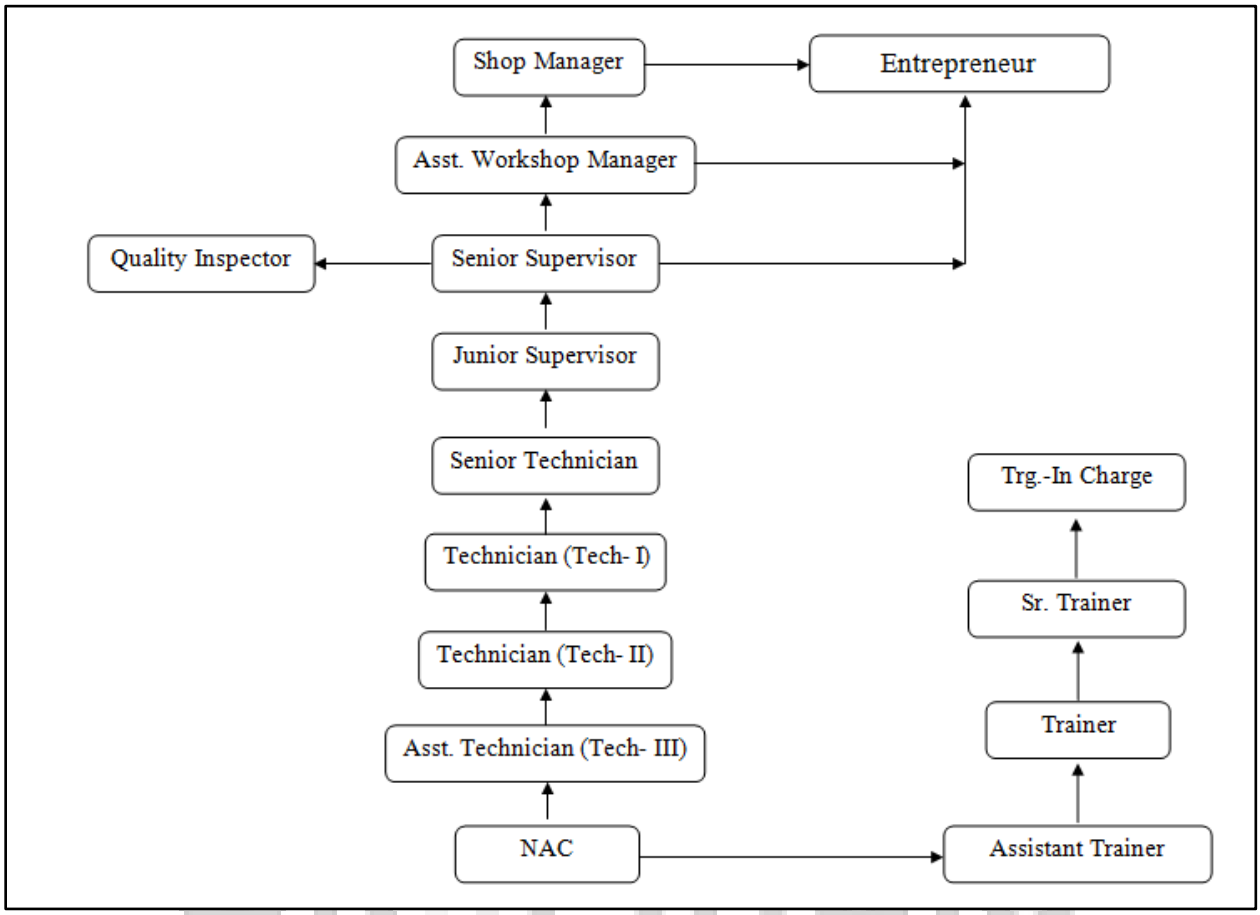
Process Plant Operator trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge,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

Broadly candidates need to demonstrate that they are able to:

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

2.2 CAREER PROGRESSION PATHWAYS:

- Indicative pathways for vertical mobility.



2.3 COURSE STRUCTURE:

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

Total training duration details: -

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

A. Basic Training

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

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

S No.	Course Element	Total Notional Training Hours	
		For 02 Yrs. course	**For 01 Yr. course**
1.	Professional Skill (Trade Practical)	550	275
2.	Professional Knowledge (Trade Theory)	240	120
3.	Workshop Calculation & Science	40	20
4.	Engineering Drawing	60	30
5.	Employability Skills	110	55
	Total (Including internal assessment)	**1000**	**500**

B. On-Job Training:-

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

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

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

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

C. Total training hours:-

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

2.4 ASSESSMENT & CERTIFICATION:

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

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure – II).

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

2.4.1 PASS REGULATION

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

2.4.2 ASSESSMENT GUIDELINE

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

Assessment will be evidence based comprising the following:

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

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

Performance Level	Evidence
(a) Weightage in the range of 60 -75% to be allotted during assessment	
For performance in this grade, the candidate with occasional guidance and showing due	• Demonstration of good skill in the use of hand tools, machine tools and workshop

regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.	equipment • Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A fairly good level of neatness and consistency in the finish • Occasional support in completing the project/job.
(b) Weightage in the range of above75% - 90% to be allotted during assessment	
For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A good level of neatness and consistency in the finish • Little support in completing the project/job
(c) Weightage in the range of above 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment • Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Brief description of Job roles:

Process Man, Chemical Process Man, Chemical process chemical ingredients by mixing in specific proportions, heating, distilling, cooling, filtering, blending, percolating, refining, pulverising, etc. for causing chemical reactions for research or production. Obtains scheme of processing from Chemist; sets apparatus and equipment; collects chemicals in required quantities; regulates feed of gaseous, liquid or solid materials into equipment. Checks progress of process by looking through peep holes, observing temperature readings, pressure gauges and other instruments and making simple chemical tests; regulates material feed, and heating and cooling devices and makes other adjustments necessary to ensure that processes are correctly carried out. Strains, filters and distils chemical substances to obtain required product in purified form. Implements safety measures in regards to operation of plant/machinery and in handling and processing materials such as acids, oils and maintains machinery. May be designated, according to type of material processed or plant in charge of, such as DISTILLING STILL ATTENDANT, FILTER PRESSMAN, etc.

Bearing Maintenance Bearing Maintenance, identify the problems in the equipment, rectify the root causes for leakages, replaces the bearings, lubricates the bearings, ensures fitness of all types of bearings in the plant and carry out routine maintenance.

Reactor Convertor Operator Reactor Converter Operator (Chemical Process, except Petr oleum) operates or tends number of pieces of equipment, other than those used for treating petroleum, which perform sequence of complex operations in chemical reaction process. Regulates feed of gaseous, liquid or solid material into equipment. Checks progress of process by looking through peep holes, observing temperature readings, pressure gauges and other instruments and making simple chemical tests. Regulates material feed and heating or cooling devices and makes other adjustments as necessary to ensure that processes are correctly carried out.

Pump Man (Petroleum Refining) Pump man (Petroleum Refining) controls pumps and manifold systems to circulate crude semi compressed and finished petroleum products, water and chemical solutions through processing and storage departments of refinery according to schedules or instructions and plans movement of product through lines of processing and storage unit, utilizing knowledge of interconnections and capacities of pipelines, valve manifolds, pumps and tanks. Synchronizes activities with other pump houses to assure continuous flow of products and minimum contamination between products. Starts battery of pumps, observes pressure and flow meter and turns valve to regulate pumping speeds according to schedules. Turns hand wheels to open line valves to direct flow of product.

Signals by telephone to operate pumps in designed units to open and closed pipeline and tank valves and to gauge, sample and determine temperature of tank contents. Records operating data, such as products and quantities pumped, stocks used, gauging results and operating time. May blend oil and gasoline. May repair pumps, lines and auxiliary equipment.

Evaporator Operator Evaporator Operator; Pan Operator; Vacuum Pan Operator charges and operates evaporating tank, vacuum-pan or similar device to concentrate solutions by driving off excess water contents. Pumps weak (liquid) solution into evaporator tank or pan; operates vacuum pump to obtain vacuum in pan, if required; regulates flow of steam into heater coils of evaporator; periodically tests concentrations of solution by use of instruments or by making simple chemical tests; makes necessary adjustments to temperature and pressure to obtain required solution; pumps concentrated solution from evaporator for auxiliary heating. Implements safety measures in regard to operation of plant/machinery and in handling and processing materials, oils and maintains machinery. May tend auxiliary equipment such as settling tanks, preheating tanks, condensers and cooling equipment. May treat solutions, such as those of glue, glycerin, glucose and caustic soda and be designated accordingly.

Continuous Still Operator, Petroleum Continuous Still Operator, Petroleum; Still man, Petroleum operates one or more continuous stills for distilling or refining crude oil to obtain fuel gas, gasoline, kerosene, diesel oil, lubricating oil, wax, bitumen, etc. Reads processing schedules, operating logs, test results of oil samples, and laboratory recommendations to determine changes in equipment controls required to produce specified quantity and quality of product; moves and sets controls, such as knobs, valves, switches, levers, and index arms on control panels to adjust, maintain, and co-ordinate process variables, such as flows, temperatures, pressures, vacuum, time, catalyst, and chemicals, by automatic regulation and remote control of processing units, such as heaters furnaces, compressors, exchangers, recharges, absorbers. Moves controls to regulate valves, pumps, compressors, and auxiliary equipment to direct flow of product, reads temperature and pressure gauges and flow meters, records readings, and compiles operating records; tests products for specific gravity and observes their color to determine whether processing is being carried out properly; makes minor adjustments to equipment; shuts down still for cleaning and opens it up again; supervises workers who assist in operation of still. May fire oil or gas burning furnace through which oil is run to heat it to processing temperature. May specialize in a particular type of still, kind of oil processed, and be designated according to process involved or plant operated as ABSORPTION PLANT OPERATOR; PURIFICATION OPERATOR; STILLMAN; CRACKING UNIT; STILLMAN, POLYMERIZATION, etc.

Crusher Operator, Chemical Crusher Operator, Chemical operates power driven crushing machine to break solid lumps of chemicals or other materials into smaller size for further processing. Collects material to be crushed; fills hopper of machine by hand or by operating

mechanical feed; fixes screen to machine to retain pieces which are too large. Operates controls to start, stop and regulate speed of machine; breaks oversize or jammed lumps with a hammer; discharges crushed material into outlet container-cleans crusher and work area. May weigh the material before and after crushing to know loss in crushing. May be designated according to type of process adopted/industry attached to.

Autoclave Operator Autoclave Operator; Sterilization Attendant charges, operates and unloads an autoclave (high-pressure vessel) for processing chemicals, oils, or sterilizing bottles, ampoules, etc. Charges or loads vessel with predetermined quantities of chemicals or objects; checks valves for operation; raises temperature of autoclave by increasing steam pressure. Observes pressure and temperature gauges, thermometers, timings and other instruments and makes necessary adjustments to ensure that process or sterilization is carried out correctly. Unloads product on completion of process and prepares vessel for next batch. Implements safety measures in regard to operation of plant/machinery and in handling and processing materials, and maintains machinery. May keep records. May be designated according to product processed or sterilized.

Batch Still Operator, Chemical Batch-Still Operator, Chemical operates one or more stills in which batches of liquid chemicals, other than petroleum, are treated to separate them into their chemical constituent such as alcohol beverages, perfume or drugs or to refine those constituents. Manipulates feed valves to fill tank with liquid to desired levels; adjusts valves to control pressure in tank and rate of heating; regulates valves to control amount of condensed vapors returned to tank to enrich vapors driven from it; draws, from containers receiving condensed vapors, product samples for testing either on their own or in laboratory; determines by purity of samples, container to which product should be routed. Maintains record of raw materials drawn, quantity consumed to indicate production capacity of plant; enters in log book condition of plant and abnormalities noticed in distillation during shift for report to Chemist. May make adjustments to still auxiliaries such as condensers and pumps. May operate ordinary type of wood-fire distillation plant. May be designated according to type of chemicals used and industry attached to e.g. AMMONIA STILL OPERATOR; ALCOHOL STILL OPERATOR; BENZENE STILL OPERATOR.

Continuous Still Operator, Chemical Continuous Still Operator, Chemical; Distillation Operator tends one or more stills in which continuous feed of liquid chemical, other than petroleum is heated to separate into chemical constituents by regulating temperature, pressure, cooling valves etc. Adjusts feed valves to allow liquid to enter still at prescribed rate; adjusts controls to maintain temperature at various levels of still and to maintain prescribed pressure in still; regulates valves to control amount of condensed vapor returned to still to enrich vapors driven from it; draws, from containers receiving condensed vapors, product samples for testing either themselves or in the laboratory; determines by purity of samples to which container product

should be routed; returns impure samples to main stock; maintains record of temperature, pressure and feed indicator readings. May make adjustments to still auxiliaries such as heat exchangers, absorbers, strippers, boilers and compressors. May specialize in type of chemical treated and be designated accordingly.

Ammonia Operator/Ammonia Plant Operator Ammonia Operator controls converter and auxiliary equipment that combine hydrogen and nitrogen to produce anhydrous ammonia: Lights burner and starts pumps, compressors, scrubbers, and absorption units. Moves controls on panel board to regulate temperatures of solutions and opens valves to admit heated and purified air and hydrogen into combustion chamber of burner, where nitrogen driven from air combines with hydrogen to form ammonia. Reads instruments, such as thermometers, pressure gauges, and potentiometers. Makes control adjustments according to operating instructions and charts. Pumps fresh solutions into scrubbing and absorption towers when readings indicate excessive alkalinity. Records operational data in logbook. May compute percentage of hydrogen and ammonia in burner gases, using standard test procedure.

Acid Plant Operator Acid Plant Operator maintains and operates acid plant for manufacturing sulphuric, hydrochloric, nitric or other acids by treating raw materials (Sulphur, salts, etc.) with acid or steam. Collects required amount of raw materials for preparation of desired acid. Sets up and checks equipment, valves, gauges and other instruments; charges vessel with predetermined amount of chemicals, or regulates feed of materials into equipment; controls temperature in vessel by adjusting steam pressure; checks progress of process by looking through peep holes, observing temperature readings, pressure gauges and other instruments and making simple chemical tests; regulates material feed and heating or cooling devices, as necessary; removes acid when process is completed. May keep records. May be designated according to product or process, e.g. SULPHURIC ACID PLANT OPERATOR; HYDROCHLORIC ACID PLANT OPERATOR; FERTILISER MAKER; PHOSPHORUS MAKER.

Digester Operator, Paper Pulp Digester Operator, Paper Pulp; Rag Boiler Operator, Paper Pulp operates boiler (cooker) to convert raw materials into paper pulp. Supervises charging of cooker with ingredients such as wood chips, rags, straw and waste paper shreds. Directs adding of chemicals and admission of steam to raise temperature and pressure. Observes gauges and makes adjustments to maintain desired operating conditions. Tests samples by titration or color tests to determine stage of cooking. When the process completes, drains liquid from digester and instructs others in removal of cooked pulp. May be designated according to materials processed or chemicals used.

Mixing Machine Man Attendant (Chemical) Mixing Machine Attendant, (Chemical) feeds and tends machine to mix and blend different solid or liquid ingredients in required proportions. Weighs ingredients according to formulae or specifications and feeds prescribed quantities of

ingredients into machine container by hand or by operating valves, pumps or mechanical loaders; starts machine agitators to mix materials thoroughly; adds further ingredients, if required; runs machine until mixing process is completed; removes mixture from machine container; cleans machine and work area and prepares machine for fresh run. Observes and reports abnormalities in blending and mixing.

Filter Press Operator Filter Press Operator operates filter press machine to filter impurities or other insoluble materials from slurries, chemical solutions or mother liquids. Opens filter press and covers filter plates with canvas, paper or other filtering media; closes press and ensures that its joints make a liquid tight seal; adds diatomaceous earth, saw dust, other settling compound to solution to precipitate impurities; pumps when specified pressure is reached. Removes filtered impurities from screen with compressed air, water or steam, and dislodges solid materials caught between frames. Occasionally replaces damaged filter media and adjusts and makes minor repairs to equipment.

Hydro Extractor Operator Hydro Extractor Operator, Centrifuge Operator operates centrifuge machine that separates solids from liquids, or liquids of different specific gravity. Fills drum of machine with liquid material. Starts machine and adjusts drum speed to obtain efficient separation of substances; empties containers when separation is completed. May fix and clean filtering media in machine, operate heating attachment on machine and test samples for moisture content. May be designated according to type of materials separated.

Drying Chamber Attendant (Drugs)/Chamber Operators Drying Chamber Attendant, Drug dries tables and powder in drying chamber. Spreads out powder and tables evenly in trays and loads trays on racks and shelves in drying chamber. Closes chamber and applies heat for fixed period of time; checks at frequent intervals to ensure that products are properly dried. Keeps drying chamber clean.

Extraction Attendant, Chemical Extraction Attendant; Chemical, Extraction Operator; Extractor Battery Attendant; Kettle Operator; Percolation Attendant; Acidification Operator boils necessary ingredients in kettles, vats, pans, and regulates temperature, pressure etc. as directed by Process man, Chemical, to effect desired chemical reaction. Collects different ingredients in required proportions and feeds them into pan separately or together, according to specification, adding required amount of fluids and other liquids, mixing them by stirrer. Switches on plant, injecting steam to boil and mix ingredients; observes temperature, pressure gauges, timings and other instruments, making adjustments, where necessary, to ensure process is complete. Collects samples for observation and test; drains stuff for storage; cleans pan and work place. Implements safety measures in regard to operation of plant/machinery and in handling and processing materials, oils and maintains machinery. May tend open or wood fire pan. May be designated according to type of pan or industry associated with.

Process Plant Operator

May be designated, according to type of material processed or plant in charge of, type of chemicals used and industry attached to, process involved or plant operated as such as DISTILLING STILL ATTENDANT, FILTER PRESSMAN, AMMONIA STILL OPERATOR; ALCOHOL STILL OPERATOR, BENZENE STILL OPERATOR. May specialize in a particular type of still, kind of oil processed, and be designated according to ABSORPTION PLANT OPERATOR; PURIFICATION OPERATOR; STILLMAN; CRACKING UNIT; STILLMAN etc.

Reference NCO-2015:

(i) 3133.0100 – Process Man, Chemical
(ii) 7233.0301 – Bearing Maintenance
(iii) 8131.3700 – Reactor Convertor Operator
(iv) 3134.0300 – Pump Man (Petroleum Refining)
(v) 8131.3600 – Evaporator Operator Evaporator
(vi) 3134.0100 – Continuous Still Operator, Petroleum
(vii) 8131.0100 – Crusher Operator, Chemical
(viii) 8131.3501 – Autoclave Operator
(ix) 3133.0400 – Batch Still Operator, Chemical
(x) 3133.0500 – Continuous Still Operator, Chemical
(xi) 8131.2100 – Ammonia Operator/Ammonia Plant Operator
(xii) 8131.7700 – Acid Plant Operator
(xiii) 3139.0100 – Digester Operator, Paper Pulp
(xiv) 8131.0400 – Mixing Machine Man Attendant (Chemical)
(xv) 8131.2300 – Filter Press Operator
(xvi) 8131.2700 – Hydro Extractor Operator
(xvii) 8131.1400 – Drying Chamber Attendant (Drugs)/Chamber Operators
(xviii) 8131.8500 – Extraction Attendant, Chemical

4. NSQF LEVEL COMPLIANCE

NSQF level for Process Plant Operator trade under ATS: **Level 5**

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

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

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

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

The Broad Learning outcome of Process Plant Operator trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

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

5. GENERAL INFORMATION

Name of the Trade	PROCESS PLANT OPERATOR
NCO - 2015	3133.0100, 7233.0301, 8131.3700, 3134.0300, 8131.3600, 3134.0100, 8131.0100, 8131.3501, 3133.0400, 3133.0500, 8131.2100, 8131.7700, 3139.0100, 8131.0400, 8131.2300, 8131.2700, 8131.1400, 8131.8500
NSQF Level	Level – 5
Duration of Apprenticeship Training (Basic Training + On-Job Training)	Two years (02 Blocks each of one year duration).
Duration of Basic Training	a) Block –I : 3 months b) Block – II : 3 months **Total duration of Basic Training: 6 months**
Duration of On-Job Training	a) Block– I: 9 months b) Block–II : 9 months **Total duration of Practical Training: 18 months**
Entry Qualification	Passed 10thclass examination under 10+2 system of education or its equivalent.
Selection of Apprenticeship	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for Basic Training	As per related Trade of ITI
Examination	The internal examination/ assessment will be held on completion of each block. Final examination for all subjects will be held at the end of course and same will be conducted by NCVT.
Rebate to Ex-ITI Trainees	1 year
CTS trades eligible for Process Plant Operator Apprenticeship	Broad Based Basic Training in Process Plant Maintenance Sector under Centre of Excellence Scheme and Advanced Module of Centre of Excellence Scheme in Operator Chemical Plant.

Note:

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

6. LEARNING OUTCOME

6.1 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/Generic Learning Outcome after completion of the Process Plant Operator course of 02 years duration under ATS.

Block I & II

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study. *[Different mathematical calculation & science – Conversion of Units, Percentage, & Mensuration-Area & Volume of different surfaces and solids, and Properties of materials, Ferrous & non-ferrous metals, Mass, weight , Density, Specific Gravity etc.].*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical figures like Triangles, Square, Rectangle, Rhombus, Parallelogram, Circle etc., Lettering & Numbering, Freehand sketching of Hand tools used for Process Plant Operator / Wireman / Electrician/ trade & wire joints, Signs & symbols for Electrical components used in electrical circuits and AC/DC systems, Electrical wiring diagram of different lamps, Schematic diagram of plate and pipe earthing, insulators used in over head line, Layout diagram of a substation, Single line Diagram of Electrical substation feeders.].*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

6.2 SPECIFIC LEARNING OUTCOME

Block – I

1. Perform even tightening of flanges of equipment or pipe line.
2. Fit pressure and vacuum gauges, thermometers etc.
3. Wind recorders, remove chart and ink pens of recorders.
4. Replace joints in pipe flanges.
5. Change belts in pulley.

6. Check valves lapping.
7. Carry out cleaning of evaporator tubes, heat exchangers etc.
8. Read process control instruments measuring flow, temperature, Pressure PH, concentration etc, their inter locking system, automatic signalling instruments for high or low pressure, temperature, flow etc.
9. Manipulate automatic control to manual control and vice versa during shut down and start up.
10. Check panel boards & identify abnormality, if any.
11. Check wiring for lighting, operation of single/three phase motors, operation of DOL starter.

Block – II

12. Measure & check Standard operation, procedure, process conditions and take corrective actions in case of the following devices/equipments available in the industry such as Pumps, compressors, blowers, fans, steam ejectors, Heat exchangers, furnaces, kilns etc.
13. Check & repair parts of Distillation units, Evaporators and condensers, Extraction units, Cooling towers and refrigeration units, Absorption towers, Dryers, Crystallizers, etc.
14. Test & repair parts of Filtration equipment, Size separation and settling equipments. Crushing and grinding equipment, Material handling and conveying equipments etc.

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

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

GENERIC LEARNING OUTCOME	
LEARNING OUTCOMES	**ASSESSMENT CRITERIA**
1. Recognize & comply safe working practices, environment regulation and housekeeping.	1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.
	1.2 Recognize and report all unsafe situations according to site policy.
	1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.
	1.4 Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
	1.12 Identify environmental pollution & contribute to avoidance of same.
	1.13 Take opportunities to use energy and materials in an environmentally friendly manner
	1.14 Avoid waste and dispose waste as per procedure
	1.15 Recognize different components of 5S and apply the same in the working environment.
2. Understand and explain different mathematical calculation & science in the field of study. *[Different*	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

mathematical calculation & science – Conversion of Units, Percentage, & Mensuration-Area & Volume of different surfaces and solids, and Properties of materials, Ferrous & non-ferrous metals, Mass, weight, Density, Specific Gravity etc.].	2.2 Measure dimensions as per drawing.
	2.3 Use scale/ tapes to measure for fitting to specification.
	2.4 Comply with given tolerance.
	2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.
	2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.
	2.7 Explain basic electricity, insulation & earthing, Different types of flow, viscosity, Reynolds's number.
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical figures like Triangles, Square, Rectangle, Rhombus, Parallelogram, Circle etc., Lettering & Numbering, Freehand sketching of Hand tools used for Process Plant Operator / Wireman / Electrician/ trade & wire joints, Signs & symbols for Electrical components used in electrical circuits and AC/DC systems, Electrical wiring diagram of different lamps, Schematic diagram of plate and pipe earthing, insulators used in over head line, Layout diagram of a substation, Single line Diagram of Electrical substation feeders.].*	3.1 Read & interpret the information on drawings and apply in executing practical work.
	3.2 Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.
	3.3 Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
	3.4 Read & interpret the signs and symbols for electrical components and AC/DC systems.
	3.5 Encounter drawings with electrical circuit diagrams and layout diagrams.
4. Select and ascertain measuring instrument and measure dimension of components and record data.	4.1 Select appropriate measuring instruments such as Ammeter, voltmeter, meggar, earth tester etc. (as per tool list).
	4.2 Ascertain the functionality & correctness of the instrument.

	4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.	5.1 Explain the concept of productivity and quality tools and apply during execution of job.
	5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.
	5.3 Knows benefits guaranteed under various acts.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.	6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available recourses optimally & remain sensitive to avoid environment pollution.
	6.2 Dispose waste following standard procedure.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.	7.1 Explain personnel finance and entrepreneurship.
	7.2 Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.
	7.3 Prepare Project report to become an entrepreneur for submission to financial institutions.
8. Plan and organize the work related to the occupation.	8.1 Use documents, drawings and recognize hazards in the work site.
	8.2 Plan workplace/ assembly location with due consideration to operational stipulation
	8.3 Communicate effectively with others and plan project tasks
	8.4 Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.
SPECIFIC OUTCOME	
Block-I & II (Section:10 in the competency based curriculum)	
*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II** (section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic*	

methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and ***Checking / Testing*** *to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	To determine Reynolds no. at different velocities. pumps (Operation and reading of pump)	Safety: Familiarization of Industrial Safety and Health Hazards.
		Mechanism of Fluid Flow, Nature of fluid, Reynolds number, Various meters for fluid flow, Control of flow and its use. Transportation of fluids. Classification, Principle and function of pumps, blower, fan compressors and conveyor elevators, Different types of Valves and Pipe fittings
2.	For a shell & tube heat exchanger. (Only operation of Heat Exchanger)	Mechanism of Heat Transfer in solid, liquid and gases and their application in industries Different types of transfer equipment- Heat exchangers, coolers, condenser and chillers Different types of boiler, steam traps, Reboilers, heaters, vaporizers, Furnace Kilns maintenance of heat exchange equipment,
3.	To find rate of evaporation for vertical tube evaporator.	Capacity, Steam economy of evaporators Surface and contact condensers, barometric condensers, Vacuum Producing devices-Steam jet ejectors, Vacuum pumps, Multi effect evaporation and methods of feeding Vapor recompression
4.	Separation of liquid mixture by distillation using packed tower	Introduction, Def of Raoult's law, & Henry's Law, Relative volatility, distillation methods, Flash differential, rectification, Azeotropic, Extractive, vacuum. Steam distillation Binary and multi compound distillation (Batch & Continuous). minimum total –optimum reflux ratio. Types of distillation column, Factor affecting efficiency. Instrumentation diagram of distillation column
5.	Study of spray extraction column	Introduction definition terms feed, solvent, extract, solute & raffinate. Selection of solvent, its properties, application of extractions equipment used for extractions, classification of equipment-single stage extraction –Agitated

		mixer, flow mixer settler multistage extraction Multistage mixer settler equipment spray towers packed towers, perforated plate towers. Leaching -Introduction, field of application , leaching equipment like percolation tank, counter current multiple contact , oil extraction from oil seeds.
6.	Calculation of flooding velocity by using packed tower	Equipments used for absorption –columns, tower packing, flooding velocity, and method of stripping.
7.	Study of super saturation Finding rate of drying by Tray Dryer.	Introduction method of super saturation and different types of crystallizes and their specific applications in industries. Theory, factors controlling constant drying rate, constant rate period, falling rate period factor affecting rate of drying, Types of dryers and uses.
8.	Operation of plate & frame filter press	Theory, different type of filters such as plate frame filter press, rotary drum filter and centrifuges
9.	Size reduction using ball mill, hammer mill. To carry out sieve analysis with sieve shaker.	Size reduction and screening, separation, Classification of crushing and grinding machineries, sedimentation – gravity session, cyclone separators Types, use of size reduction equipment i.e black jaw crusher ,hammer mill, ball mill.
10.	Study of Conveyor, elevators	Conveyor, elevators Pneumatic transportation – pressure and vacuum
11.	Determination of wet bulb & dry bulb temperature.	Theory of Humidification and different terms related to Humidification .Theory and different types of cooling towers
12.	Study of refrigeration units	Vapor absorption and vapor (Introductory Parts) recompression system, different types of refrigents and their properties and specific use in industries
13	**Assessment/Examination 03days**	

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

BASIC TRAINING (Block – II)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1	To determine the purity of given H_2SO_4 acid sample To determine the purity of given HNO_3 acid sample Study expt.	Manufacturing of sulphuric acid by contact process Manufacturing of water gas, Nitrogen industries, Manufacturing of Ammonia by synthesis gas, Manufacturing of Nitric acid by ammonia oxidation process, Manufacturing of urea from ammonium carbonate, Manufacturing of Portland cement,
2	Process of sulphated fatty alcohol. Paint & varnish Manufacturing process of sugar from sugar cane Manufacturing process of ethyl alcohol by fermentation method, Manufacturing process of pulp by sulfate process, Manufacturing process of paper from pulp, Manufacturing process of petroleum by refining process	Vegetable oil extraction method sulfated fatty alcohol. Paint & varnish Manufacturing of sugar from sugar cane Manufacturing of ethyl alcohol by fermentation method, Manufacturing of pulp by sulfate process, Manufacturing of paper from pulp, Manufacturing of petroleum by refining process
3	To determine the process of methanol, benzene by alkyl aromatics, phenol.	Manufacturing of methanol, Manufacturing of benzene by alkyl aromatics, Manufacturing of phenol by cumene process, Manufacturing of 2, 4 – dichlorophenol
4	Find the flow chart of pharmaceutical industry and determine the process	Manufacturing of aspirin
	Manufacturing process of polyvinyl chloride, bakelite	Manufacturing of polyvinyl chloride, bakelite
	Manufacturing process of wines, bears by fermentation process	Manufacturing of wines, bears by fermentation process
5	Study of COD of given water sample Methods of Sampling of solid, Liquid and Sampling Techniques	1) Sources of water and water quality. Water pollutants-Organic, inorganic, Sediments, thermal, Radioactive, biological 2) Sources of water pollution 3) Treatment of water – purification, Sedimentation, Coagulation, Filtration, Sterilization (Physical and Chemical methods of Sterilization 4) Water Softening (Removal of hardness) -Boiling, Distillation, Clark's Method,

		Caustic soda process, Ion exchange
6	Study of BOD of given water sample To determine pH by pH METER Of Given Sample	5) Effluent, types & source of effluent 6) Effluent analysis (PH, COD, BOD, TSS, Clarity 7) Treatment of effluent 8) Types of equipments use for treatment
7	Determine the TDS of given water sample	9) Permissible standards 10) Air pollution 11) Types of pollutants 12) Sources of pollutants
8	Determine the TSS of given water sample	13) Effect of air pollution 14. Analyse the air pollution by SENSOR (Only Introduction) 15) Equipment use for measurement and control of air pollution 16) Permissible standards
9	**Maintenance of pipe line and valves** Cutting and threading of pipes. Bending and fitting of pipe as per drawing. Fitting of different types of pipe joints use of quick released coupling.	Pipe and pipe joints. Pipe bending fixture. Standard pipe threads. Tap and dies Standard pipefitting.
	Maintenance of globe valve, Gate valve, Stop cock, Non return valve, ball valve, needle valve, Pneumatic valve, butterfly valve and fitting of different type of valves on pipe line.	Construction and future of different types of valves. Metallurgy – Corrosion along with respect to corrosion. Selection of metal for chemical application. Lining material. Metal testing method destructive and non destructive.
10	**Maintenance of machinery** Maintenance compressor, blowers, crushers, mixers and pulverizes.	Construction use of compressor, blower, crusher, mixer, and pulverizes.
11	**Maintenance of Pumps** Maintenance and assembly of different type of pump such as centrifugal pump, gear pump, plunger pump, RPM,	Type of pumps their construction details and use.
12	Fitting of bearing such as ball bearing, roller bearing, bush bearing etc their care. Lubrication and maintenance. Removing bearing with bearing puller (INTRODUCTARY PARTS ONLY)	Bearing their type material and use information about bearing removing and fitting kit. Lubricant and lubrication type of lubricant and method of lubrication. Properties of lubricant
13	**Assessment/Examination 03 days**	

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

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	**Engineering Drawing: Introduction and its importance** - Viewing of engineering drawing sheets. Method of Folding of printed Drawing Sheet as per BIS SP:46-2003 **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.	Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals	**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 - Methods of Division of line segment
3.	**Percentage**: Introduction, Simple calculation.	**Drawing of Geometrical Figures**: Definition, nomenclature and practice of - - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements
4.	**Material Science**: properties - Physical & Mechanical, Types – Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals.	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
5.	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.	Free Hand sketch of hand tools, measuring tools used in Electrician /wireman/ Lineman trade. Free hand sketch of wire joints.

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Mass ,Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals	**Signs & Symbols of AC/DC System** Symbols used in electrical circuits. Electrical components.
2.	Square Root: Square and square root, method of finding out square roots. Simple problem using calculation.	Electrical wiring diagram of different lamps, room (3/4 point), stair case. Schematic diagram of plate and pipe earthing,
3.	**Mensuration :** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Surface area of solids – cube, cuboid, cylinder and Sphere.	Types of insulator used in over head line. (Half sectional views)
4.	Volume of solids – cube, cuboid, cylinder and Sphere measurement of angles.	Layout diagram of a substation. Single line Diagram of Electrical substation feeders.

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

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

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

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

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

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

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

Block – I

1. Perform even tightening of flanges of equipment or pipe line.
2. Fit pressure and vacuum gauges, thermometers etc.
3. Wind recorders, remove chart and ink pens of recorders.
4. Replace joints in pipe flanges.
5. Change belts in pulley.
6. Check valves lapping.
7. Carry out cleaning of evaporator tubes, heat exchangers etc.
8. Read process control instruments measuring flow, temperature, Pressure PH, concentration etc, their inter locking system, automatic signalling instruments for high or low pressure, temperature, flow etc.
9. Manipulate automatic control to manual control and vice versa during shut down and start up.
10. Check panel boards & identify abnormality, if any.
11. Check wiring for lighting, operation of single/three phase motors, operation of DOL starter.

Block – II

12. Measure & check Standard operation, procedure, process conditions and take corrective actions in case of the following devices/equipments available in the industry such as Pumps, compressors, blowers, fans, steam ejectors, Heat exchangers, furnaces, kilns etc.
13. Check & repair parts of Distillation units, Evaporators and condensers, Extraction units, Cooling towers and refrigeration units, Absorption towers, Dryers, Crystallizers, etc.
14. Test & repair parts of Filtration equipment, Size separation and settling equipments. Crushing and grinding equipment, Material handling and conveying equipments etc.

Note:

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

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

PROCESS PLANT OPERATOR			
LIST OF TOOLS AND EQUIPMENT for Basic Training			
A. TRAINEES TOOL KIT			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1.	Reynolds's Experiment equipment		1 Set
2.	Shell and tube heat exchanger glass type		1 No.
3.	Boiler (Electrically Heated)		1 No.
4.	Vertical Tube Evaporator		1 No.
5.	Packed tower of glass for flooding velocity experiment		1 No.
6.	Top driven centrifuge		1 No.
7.	Rotary vacuum filter		1 No.
8.	Tray drier		1 No.
9.	Hammer mill		1 No.
10.	Ball mill		1 No.
11.	Blake jaw crusher		1 No.
12.	Mixer settler type extractor		1 No.
13.	Spray extraction tower		1 No.
14.	Multistage compressor fitted with inter cooler		1 No.
15.	Sieve shaker and sieves		1 No.
16.	Annular (for flow of fluids)		1 No.
17.	Vacuum pump with mechanical Seals		1 No.
18.	Vacuum pump with normal gland packing		1 No.
19.	Multipass heat exchanger		1 No.
20.	Magnetic flow (Rota meter)		1 No.
21.	Screw pumps for viscous flow		1 No.
22.	Metering pump		1 No.
23.	Rotary air lock valve		1 No.
24.	Plate heat exchanger		
25.	Spiral heat exchanger		1 No.
26.	Glass Tube heat exchanger		1 No.
27.	Rising film and fallowing film Evaporators		1 No.
28.	Bruck field viscometer		1 No.
29.	Crystallizers – Flickers		1 No.
30.	Absorption- striping		1 No.
31.	Dryer, Pedal dryer,		1 No.
32.	Filtration – Lift filter, Sparker filter, Notch filter, -		1 No.

	filtration media, (FILTER CLOTH) Micron size		
33.	Explosive meters for safety i) Gas detector ii) Smoke detector iii) Fire alarm system iv) Sprinklers system for safety		1 No.
34.	Humidification /Dehumidification and air handling unit		1 No.
35.	Solenoid valve		2
36.	Pneumatic control valve		2
37.	Safety valve		2
38.	Cooling tower (common for instrumentation lab)		2
39.	Pressure vessel with all accessories (training type)		2
40.	Divider spring 6”/15cm		20 nos.
41.	Center punch 4”/10cm		20 nos.
42.	Chisel cold flat 1”/2.5cm		20 nos.
43.	Hammer ball pain 1lb handle		20 nos.
44.	Hack saw frame adjustable with pistol gripe for 8”-12” blade by 20cm-30cm		20 nos.
45.	Steel rule 12” English & metric /30cm		20 nos.
46.	Safety goggles		20 nos.
47.	Soldering gun with stand		20 nos.
48.	De soldering pump		20 nos.
49.	Connector		20 nos.
50.	Safety shoes		20 nos.
51.	Magnetic point screw driver		20 nos.
52.	Combination pliers		20 nos.
53.	Long nose pliers		20 nos.
54.	Insulator fine cutter		20 nos.
WORKSHOP FURNITURE			
55.	Storage rack		2 nos.
56.	Storage cupboard		2 nos.
57.	Instructor table		1 no.
58.	Instructor chair		1 no.
59.	Work bench with vice		4 nos.
60.	Stool		17 nos.
61.	Trainee locker (8 compartment)		2 nos.
62.	Green board		1 no.
63.	Fire fighting equipment		1 no.
64.	First aid box		1 no.
65.	Discussion table		2 nos.
66.	Tool cabinet		1 no.
67.	Book shelf		1 no.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: PROCESS PLANT OPERATOR

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**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box		21
2.	Set square celluloid 45^o	(250 X 1.5 mm)	21
3.	Set square celluloid 30^o-60^o	(250 X 1.5 mm)	21
4.	Mini drafter		21
5.	Drawing board IS: 1444	(700mm x500 mm)	21
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		20
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01
6	White Board	(size: 8ft. x 4ft.)	01
7	Trainer's Table		01
8	Trainer's Chair		01

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

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

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

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