# OPERATOR CUM MECHANIC POLLUTION CONTROL EQUIPMENT

## COMPETENCY BASED CURRICULUM

**(Duration: 2 Yrs.)**

## APPRENTICESHIP TRAINING SCHEME (ATS)

**NSQF LEVEL- 5**

**SECTOR – Capital Goods & Manufacturing**


सत्यमेव जयते

GOVERNMENT OF INDIA

MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP

DIRECTORATE GENERAL OF TRAINING

# OPERATOR CUM MECHANIC POLLUTION CONTROL EQUIPMENT

**(Revised in 2018)**

## APPRENTICESHIP TRAINING SCHEME (ATS)



**NSQF LEVEL - 5**

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**
EN-81, Sector-V, Salt Lake City,
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Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

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## CONTENTS

# 1. BACKGROUND

## 1.1 Apprenticeship Training Scheme under Apprentice Act1961

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 Directorate General of Training (DGT) to develop skilled manpower for the industry**.** There are four categories of apprentices namely**; trade apprentice, graduate (engineers), technician (diploma) and technician (vocational) apprentices.**

Entry 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 DGT and those successful in the trade tests are awarded the National Apprenticeship Certificate (NAC) by DGT having worldwide recognition.

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. It will ensure stronger collaboration between industry and the trainees which will augment supply of skilled workforce and enable 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 Directorate General of Training (DGT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of DGT for propagating vocational training.

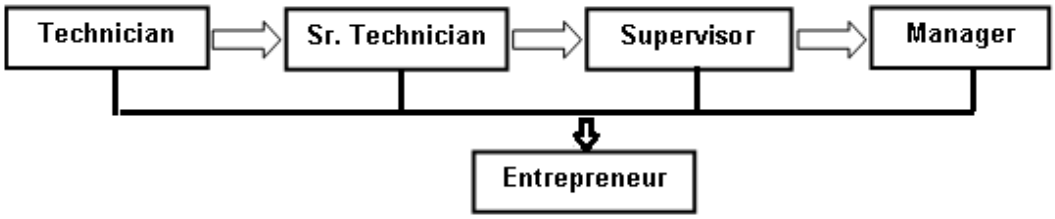
Operator Cum Mechanic Pollution Control Equipment trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - 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 DGT 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:

- On completion of the training the trainee will have an opportunity to move in vertical/horizontal pathways to promote to higher designations. The trainee can further undergo other specialised courses to excel in the relevant field.




## 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** | **BT– I** | **-----** | **BT – II** | **------** |
| **Practical Training (On - job training)** | **----** | **OJT – I** | **------** | **OJT – II** |

**A. Basic Training**

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

| S No. | Course Element | Total Notional Training Hours (For 02 Yrs. Course) |
|---|---|---|
| 1. | Professional Skill (Trade Practical) | 550 |
| 2. | Professional Knowledge (Trade Theory) | 240 |
| 3. | Workshop Calculation & Science | 40 |
| 4. | Engineering Drawing | 60 |
| 5. | Employability Skills | 110 |
| | **Total (Including formative assessment)** | **1000** |

**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.

**C. Total training hours:-**

| Duration | Basic Training | On-Job Training | Total |
|---|---|---|---|
| **For 02 yrs. course** (Engg.) | 1000 hrs. | 3120 hrs. | 4120 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.

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 formative 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 DGT 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 percentage is 40% for each Theory Examination (except for Employability Skill it is 34%) and 60% marks for each Trade practical Examination. The candidate should 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 formative assessments are to be preserved until forthcoming 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 regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship. | • Demonstration of good skill in the use of hand tools, machine tools and workshop equipment<br>• 60-70% accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A fairly good level of neatness and consistency in the finish<br>• 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<br>• 70-80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A good level of neatness and consistency in the finish<br>• 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 | • High skill levels in the use of hand tools, machine tools and workshop equipment |

| | |
|---|---|
| organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship. | • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job/set standards.<br>• A high level of neatness and consistency in the finish.<br>• Minimal or no support in completing the project. |

# 3. JOB ROLE

**Brief description of Job roles:**

**Environment Science and Protection Technician, Including Health** records test data and prepares reports, summaries, and charts that interpret test results. Collects samples of gases, soils, water, industrial wastewater, and asbestos products to conduct tests on pollutant levels and identify sources of pollution. Respond to and investigate hazardous conditions or spills, or outbreaks of disease or food poisoning, collecting samples for analysis. Provides information and technical and programme assistance to government Representatives, employers and the general public on the issues of public health, environmental protection or workplace safety. Calibrates microscopes and test instruments. Makes recommendations to control or eliminate unsafe conditions at workplaces or public facilities. Inspects sanitary conditions at public facilities. Prepares samples or photomicrographs for testing and analysis. Calculates amount of pollutant in samples or computes air pollution or gas flow in industrial processes, using chemical and mathematical formulas. Initiates procedures to close down or fine establishments violating environmental and/or health regulations.

**Environmental Engineering Technician** Environmental Engineering Technician applies theory and principles of environmental engineering to modify, test, and operate equipment and devices used in the prevention, control, and remediation of environmental pollution, including waste treatment and site remediation. May assist in the development of environmental pollution remediation devices under direction of engineer. Perform environmental quality work in field and office settings. Receive, setup, test, and decontaminate equipment. Arranges for the disposal of lead, asbestos and other hazardous materials. Assists in the cleanup of hazardous material spills. Conducts pollution surveys, collecting and analyzing samples such as air and groundwater. Develops work plans, including writing specifications and establishing material, manpower and facilities needed. Inspect facilities to monitor compliance with regulations governing substances such as asbestos, lead, and wastewater.

**Reference NCO 2015:**

I. 2133.0200 – Environment Science and Protection Technician, Including Health
II. 3257.0500 – Environmental Engineering Technician

# 4. NSQF LEVEL COMPLIANCE

NSQF level for Operator Cum Mechanic Pollution Control Equipment 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 Operator Cum Mechanic Pollution Control Equipment 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** | Operator Cum Mechanic Pollution Control Equipment |
| **NCO - 2015** | 2133.0200, 3257.0500 |
| **Trade Code** | DGT/3198 |
| **NSQF Level** | Level – 5 |
| **Duration of Apprenticeship Training** (Basic Training + On-Job Training) | Two years |
| **Duration of Basic Training** | a) BT –I: 3 months<br>b) BT – II: 3 months<br>**Total duration of Basic Training: 6 months** |
| **Duration of On-Job Training** | a) OJT–I: 9 months<br>b) OJT–II: 9 months<br>**Total duration of Practical Training: 18 months** |
| **Entry Qualification** | Passed Higher Secondary Examination with physics& Biology 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 year.<br>Final examination for all subjects will be held at the end of course and same will be conducted by DGT. |
| **Rebate to Ex-ITI Trainees** | – |
| **CTS trades eligible for OPERATOR CUM MECHANIC POLLUTION CONTROL Equipment Apprenticeship** | – |

***Note:***

- *Industry may impart training as per above time schedule for different OJT, 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 DGT.*

# 6. LEARNING OUTCOME

## 6.1 SPECIFIC LEARNING OUTCOME

The following are minimum broad Specific Learning Outcome after completion of the Operator Cum Mechanic Pollution Control Equipment course of 02 years duration under ATS:

### 1st Year:-

1. Identify various sources of pollution, its causes & effect on environment & humanity.
2. Identify, operate, maintain & troubleshoot AC Power line, AC motors & Pumps.
3. Measure process variables like temperature, pressures, flow, level etc. by respective process instruments.
4. Prepare and assist in the volumetric analysis as well as in use of microscope.
5. Detect the pollutant samples and report for necessary control.

### 2nd Year:-

6. Operate electronic measuring and sensing instruments, pneumatic and electro pneumatic controls, hydraulic & electro hydraulic controls.
7. Utilize analyzer of various types viz.COD, BOD, PH, ION, $SO_2$, CO, NO/$NC_X$ and Oxygen etc.
8. Identify boilers and their various controls including precipitators, recycling systems and dust suppressors.
9. Identify, select, operate & maintain various pollution monitoring instruments needed for pollution control.

## 6.2 GENERIC LEARNING OUTCOME

The following are minimum broad Common Occupational Skills/Generic Learning Outcome after completion of the Operator Cum Mechanic Pollution Control Equipment course of 02 years duration under ATS:

**YEAR I & II: -**

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science – Standard units for environmental studies, Properties of 'Co1, A11 & insulating material. Resistance, inductance, capacitance & Series & Parallel circuits etc.]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing- Free hand sketching*

*with dimension of simple solid such as cubes, rectangular blocks, cylinders, cones etc., Writing single stroke letters and numbers as per BIS 696-1976 (2nd Revision), Free hand drawing of instruments related with measurement of temperature, pressure, level and flow]*

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.

***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

| SPECIFIC LEARNING OUTCOME | |
|---|---|
| **LEARNING OUTCOMES** | **ASSESSMENT CRITERIA** |
| **1st Year**<br>1. Identify various sources of pollution, its causes & effect on environment & humanity.<br>2. Identify, operate, maintain & troubleshoot AC Power line, AC motors & Pumps.<br>3. Measure process variables like temperature, pressures, flow, level etc. by respective process instruments.<br>4. Prepare and assist in the volumetric analysis as well as in use of microscope.<br>5. Detect the pollutant samples and report for necessary control.<br><br>**2nd Year**<br>6. Operate electronic measuring and sensing instruments, pneumatic and electro pneumatic controls, hydraulic & electro hydraulic controls.<br>7. Utilize analyzer of various types viz.COD, BOD, PH, ION, $SO_2$, CO, NO/$NC_X$ and Oxygen etc.<br>8. Identify boilers and their various controls including precipitators, recycling systems and dust suppressors.<br>9. Identify, select, operate & maintain various pollution monitoring instruments needed for pollution control. | *Assessment Criteria for each specific learning outcome mentioned under **1st year & 2nd year** (section: 10) ensures the trainee achieves well developed skill with clear choice of procedure in familiar context.*<br>*Assessment criteria should broadly cover the aspect of –*<br>***Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying –*<br>*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*<br>*2) Knowledge of facts, principles, processes, and general concepts, in the field of work or study 3) Desired Mathematical Skills and some skill of collecting and organizing information, communication) and*<br>***Checking / Testing** to ensure functionality during the assessment of each outcome.*<br>*The assessments parameters also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.* |

| GENERIC LEARNING OUTCOME | |
|---|---|
| **LEARNING OUTCOMES** | **ASSESSMENT CRITERIA** |
| 1. Recognize & comply safe working practices, environment regulation and housekeeping. | 1.1 Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements. |
| | 1.2 Recognize and report all unsafe situations according to site policy. |
| | 1.3 Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures. |
| | 1.4 Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements. |
| | 1.5 Identify and observe site policies and procedures in regard to illness or accident. |
| | 1.6 Identify safety alarms accurately. |
| | 1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures. |
| | 1.8 Identify and observe site evacuation procedures according to site policy. |
| | 1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment. |
| | 1.10 Identify basic first aid and use them under different circumstances. |
| | 1.11 Identify different fire extinguisher and use the same as per requirement. |
| | 1.12 Identify environmental pollution & contribute to avoidance of same. |
| | 1.13 Take opportunities to use energy and materials in an environmentally friendly manner |
| | 1.14 Avoid waste and dispose waste as per procedure |
| | 1.15 Recognize different components of 5S and apply the same in the working environment. |
| | |
| 2. Understand, explain different mathematical calculation & science in the field of study including basic electrical and apply in day to day | 2.1 Explain concept -Standard units for environmental studies, Role of Pollution control Equipment Operator the required knowledge base, Fundamental derived units, limits and tolerances, Properties of 'Co[1], A1[1]& insulating material. Resistance, inductance, capacitance & Series & |

| | | |
|---|---|---|
| work.*[Different mathematical calculation & science – Standard units for environmental studies, Properties of 'Co1, A11 & insulating material. Resistance, inductance, capacitance & Series & Parallel circuits etc.]* | | Parallel circuits, Chemical bonding oxidation-Reduction of acids & bases. |
| | 2.2 | Measure dimensions as per drawing. |
| | 2.3 | Use scale/ tapes to measure for fitting to specification. |
| | 2.4 | Comply given tolerance. |
| | 2.5 | Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials. |
| | 2.6 | Ensure accuracy of measurements by using different instruments/gauges. |
| | 2.7 | Explain basic electricity, insulation &earthing. |
| | | |
| 3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing- Free hand sketching with dimension of simple solid such as cubes, rectangular blocks, cylinders, cones etc., Writing single stroke letters and numbers as per BIS 696-1976 (2nd Revision), Free hand drawing of instruments related with measurement of temperature, pressure, level and flow]* | 3.1 | Read & interpret the information on drawings and apply in executing practical work. |
| | 3.2 | Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters. |
| | 3.3 | Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
| | | |
| 4. Select and ascertain measuring instrument and measure dimension of components and record data. | 4.1 | Select appropriate measuring instruments as per tool list. |
| | 4.2 | Ascertain the functionality & correctness of the instrument. |
| | 4.3 | Measure dimension of the components & record data to analyse with the given drawing/measurement. |
| | | |
| 5. Explain the concept in productivity, quality tools, | 5.1 | Explain the concept of productivity and quality tools and apply during execution of job. |

| | | |
|---|---|---|
| | and labour welfare legislation and apply such in day to day work to improve productivity & quality. | 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. |

## 8. SYLLABUS

| **BASIC TRAINING (BT – I)**<br>**Duration: (03) Three Months** | | |
|---|---|---|
| **Week No.** | **Professional Skills (Trade Practical)** | **Professional Knowledge (Trade Theory)** |
| 1 | Familiarization with the Institute: Type of training Safety & First Aid.<br>Familiarization with Pollution Control Equipment & their functions.<br>Sources of Pollution Natural & Anthropogenic effect of industrialization. | Introduction to trade and subjects to be covered.<br>Define pollution & their effect on environment & humanity.<br>Natural Resources, their exploitation & replacement. |
| 2 | Reading of Engineering Drawing, Marking & use of simple marking tools.<br>Use of simple hand tools like Hacksaw blades, files hammers etc.<br>Drilling, Tapping, Fixing stud & removing broken stud. Hand reaming and fitting dowel pan. | Natural carbon cycle effect of human intervention.<br>Natural water cycle.<br>Nitrogen cycle; effect of using too much fertilizer. |
| 3-4 | Inspection & Checking longitudinal/angular parallelism, sureness, flatness, concentricity etc.<br>Use of sheet metal tools& equipment. Making points, soldering & Brazing on sheet metal.<br>Practice in connecting simple electrical accessories like switches sockets. Lamp holders, fluorescent tube etc. Testing with lamp, bell, fuses etc. | Atmosphere Stratosphere etc. & interaction between living &non living things.<br>Sun – the ultimate source of energy. Relationship between animal & plant kingdom<br>Wind & Ocean currents. Creation of low and high pressure. Cloud cover and precipitation. |
| 5-6 | Transducers & different type of sensors:-<br>Temperature, pressure, flow, level etc.<br>Care, maintenance and running of vacuum pump, compressor, blower etc.<br>Use of thermometers, pyrometers, thermocouple etc.<br>Measurement of pressure, use of pressure and vacuum gauges. Use of pitot tube and manometer.<br>Flow measurement, use of flow meter, rotameter, pitot tube & manometer, orifice, venture meters etc. | Introduction to ICs and its parameters. AD converters. Construction and principle of stable supply and its necessity.<br>Effect of pressure on solids, liquids and gases change in melting, boiling point.<br>Thermal expansion of gases, Adiabatic and Isothermal. Laws of thermodynamics.<br>Bernoulli's Theorem concept of potential and kinetic energy.<br>Principle of operation of flow meter & their constructional details. |
| 7 | Preparation of solutions of solids. | Introduction to analytical chemistry. |

| | | |
|---|---|---|
| | Liquids, volatile & nonvolatile etc.<br>Volumetric analysis of acids, bases & salts. Simple titration.<br>Iodometric titration using iodine solution.<br>Precipitation titration.<br>Complex metric titration.<br>Gravimetric analysis and estimation.<br>Inorganic qualitative analysis. | Atomic theory & the laws of chemical combination.<br>Properties of acids and bases.<br>Chemical equilibrium & thermo chemistry.<br>Atomic, molecular & equivalent weight, crystallography.<br>Colloidal osmosis catalysis, allotropy.<br>Study of periodic table. Radioactivity<br>Electro-chemistry & electrolysis. |
| 8 | Use of chemical and electronic balance & microscope.<br>Use of Pyknometer. Aim apparatus & chemicals required. | Introduction to organic chemistry.<br>Molecular formula & chemical compared. |
| 9 | Use of boiling & melting point apparatus. Viscometer and surface tension apparatus. | Units and dimensions and their conversion. |
| 10 | Use of PH meter, paleography & calorimeter<br>Photo-calorimeter, bomb calorimeter, flame calorimeter & refractometer. | Determination of acid value & saponification value of oil & fat.<br>Theory & principle of operation. Thermo chemistry, heat of dissolving & heat of chemical reactions. |
| 11 | Chemical analysis by electrical energy. | Radio chemistry & decay time of radio isotopes. |
| 12 | Use of electrophoresis apparatus.<br>Use of orsat apparatus.<br>Gas & liquid chromatography apparatus. | Theory & principle of operation.<br>Theory of gas & liquid chromatography. |
| 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 (BT – II)**<br>**Duration: (03) Three Months** | | |
|---|---|---|
| **Week No.** | **Professional Skills (Trade Practical)** | **Professional Knowledge (Trade Theory)** |
| 1 | Identification of PC components – keyboard, CPU, VDU, Printer.<br>Starting a computer for use of DOS, commands. Creation of files, fields and records. Entering and listing data. Modifying & editing a data base.<br>Practice in word processing, spread sheet and data base programme. | Concept of PC operation and operating systems- idea on memory hard disc, floppy drives and other storage devices.<br><br>Preparation of a data base storing and retrieval of data. Report generation data base magnet system. |
| 2 | Identification of pneumatic components single and double acting cylinder service unit. Direction control valve, pressure control valve, flow control valve. NRV, time dependant valve, quick exhaust etc. indirect trigging of SA & DA cylinders speed regulation of SA & DA cylinder, time dependent reversal of DA cylinder coordinated motion of two and three cylinders. | Graphical symbol for fluid power systems. Introduction to pneumatic advantages of pneumatic systems. Properties of Air, treatment of air, moisture of air, removal of dirt & moisture from air, pneumatic working element. |
| 3 | Identification of Electro pneumatic components: - 5/3, 5/2, 4/2, 3/2, Directional control valves (solenoid) relays operation & control of A & DA cylinders.<br>Oscillating motion of a DA cylinder. | Introduction of electro –pneumatics.<br>Electro-pneumatic working elements. Solenoid valves, pressure switch, limit switch timers & relays memory & latching circuits. |
| 4 | Practice on Hydraulic jack. Dismantling & Assembling of directional control valve & hydraulic cylinders gear pump.<br>Practical on the hydraulic trainer.<br>1) Reciprocating of cylinders.<br>2) Regenerative circuit.<br>3) Traverse and feed circuit, meter – in, meter –out, bleed off circuit<br>4) Practice on electro hydraulic trainer. | Basic principles of hydraulics – advantages of hydraulic systems Pascal's law-hydraulic leverage-multiplication of forces. Introduction to hydraulic working elements.<br>Hydraulic pumps- positive displacement pumps gear, vane & piston pumps-accumulator.<br>Hydraulic oil, oil filtration, seals of fluid power electro-hydraulic valves, servo valves. |
| 5-6 | Unit operations, principles of physical treatment & chemical treatment or regulation & biological treatment.<br>Elementary knowledge of COD analyzer | Water & soil pollution, identification of possible sources, General industrial water pollutants (viz.) –<br>a) Sewage |

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| | COD determination by electronic and chemical methods.<br>Elementary knowledge of OV-VIS spectrophotometry & atomic absorption spectrophotometry measurement of toxic metals in water & soil.<br>Elementary knowledge Ion-analyzer toxic non-metals CN, F, C1, So4 by Ion selective electrodes.<br>Sample preparation from different sediment for analysis of particle size by using sieves. | b) Indicative agents<br>c) Suspended soil<br>d) Oil & fat<br>e) Heavy metals<br>f) Colour<br>g) Odour<br>h) Detergents<br>i) Effluents<br>Working of the analyzer with acceptable limits of BOD & COD and their effects on human health the help of block diag.<br>Toxic metals in water and soil-acceptable limits –<br>Their effects on health (viz.) As, Ni, Cr, Zn, Cd, Sb, Bi, V, Cu<br>Toxic non-metals in water and soil such as cyanide-CN, Flouride-F, sulphate So4, Chloride- C1- acceptable limits, their effects on health<br>Sediment analysis dissolution procedure for analysis of toxic metals. |
| 7-8 | Test for drinking water as per IS 10500-83. Each as 1) Dissolved solid, 2) PH-valve, 3) Calcium, 4) Magnesium 5) Copper 6) Iron 7) Chloride 8) Sulphate, 9) Flouride, 10) phenolic, 11) Mercury 12) Cadmium 13) Selenium 14) Arsenic water for Industrial purposes. | Water and effluent treatment methods<br>1) Sedimentation<br>2) Filtration<br>3) Ion exchange<br>4) Plankton<br>5) Hyacinth<br>6) Fungus<br>7) Lime treatment<br>8) Sodium sulphate treatment |
| 9 | Concept of chimney grates.<br>Study of draft control system & necessity of excess air.<br>Study of positive and negative pressure stacks, necessity of stack temperature control.<br>Study of Low $No_x$ burners & their maintenance.<br>Operation & Maintenance of grit arrestors, cyclones, multi-cyclones &grit recycling systems.<br>Operation and maintenance of Electro-static precipitators.<br>Operation & maintenance of dust | Burners and fuel system.<br>Combustion of coal and oil & the type of pollutants generated.<br>Heat transfer system, conduction, convection & radiation.<br>Stack height & its relationship with draft.<br>Due point of $So_2$ and cause of acid rain.<br>Mechanism of no generation and the principle of operation of Low $No_x$ burners.<br>Elementary knowledge of the operations of GRIT arrestors cyclone, multi-cyclone &GRIT Recycling system and precautions in their handling. |

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| | suppressers. | Principle of Operation of electro-static precipitators.<br>Elementary knowledge of their maintenance positioning of sprinklers for suppression of dust. Effectiveness of plant & creepers as dust suppressor and elementary knowledge of their maintenance. |
| 10 | Study of other anthropogenic pollutants in atmosphere & their harmful effects.<br>Wind speed and direction recorder. Their use & methods.<br>Elementary knowledge of cloud cover. Use of hygrometer.<br>Maintenance & use of stack monitoring kit. Preparation of sampling taking necessary precautions.<br>Determination of static pressure and differential pressure with pitot tube & inclined manometer.<br>Fixation of sampling point & No. of traverse points. | Concept of the effects of CFC on ozone layer. Formation of ozone hole & its adverse effect.<br>The atmospheric effect of temp, pressure and wind.<br>Effect of humidity on dispersion stable & unstable atmosphere.<br>Element knowledge of isokinetic sampling.<br>Basic idea of operation of pitot tube and manometer.<br>Aerodynamic principles of uniform laminar flow.<br>Statutory limits of various pollutants in stack. |
| 11 | Acquaintance with continuous monitoring analyzers &heated sample line.<br>Elementary knowledge of No/NC analyzer & its preventive maintenance.<br>Operation & preventive maintenance of sample conditioning unit for $So_2$& NC/$No_x$ analyzers.<br>Operation of co analyzer & its preventive maintenance. Use of NCISE-level mentoring meter & its preventive maintenance.<br>Dismantling & assembling of globe valves check valves, needle valves, diaphragm valves ball valve, stop cork, butter fly valve. Operation of reciprocation compressors single/multistage.<br>Concept of $So_2$ analyzer and its preventive maintenance. | Necessity of continuous monitoring under changing condition like that in power stations<br>Chemiluminescence principles of analysis.<br>Sample conditioning. Its requirement & methods. Elementary knowledge of non-dispersive infra-red absorption principles.<br>Sample conditioning. Its requirement & methods. Effects of noise on human permissible exposure time for occupational noise level.<br>Application of various types of valves. Maintenance & trouble shooting of compressor.<br>Fluorescence principle of analysis. |

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| 12 | Preventive maintenance of treatment units the basic requirement.<br>Proper use of screens, maintenance of mechanical screens. Elementary knowledge of maintenance of grid chambers.<br>Elementary knowledge of maintenance of sedimentation tanks & its accessories. Handling & maintenance of skimming services mechanical skimmers. Operation & maintenance of recorders. Maintenance of trickling filters. Use & Maintenance of heater types.<br>Data collecting for central information compilation &forwarding. | The water (prevention and control of pollution) Act. 1974. The central & state board for prevention & control of water pollution.<br>The environment (protection) Act, 1986. General powers of central Govt. liquid effluent & its treatment/disposal methods. Record & recording systems digester beds. Stabilization ponds usage & design.<br>Pollution central acts study of level aspects both for central Govt. and State Govt. for air and earth pollution. |
| 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.*

# 9. SYLLABUS - CORE SKILLS

## 9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

| BT – I | | |
|---|---|---|
| **Sl. No.** | **Workshop Calculation and Science (Duration: - 20 hrs.)** | **Engineering Drawing (Duration: - 30 hrs.)** |
| 1. | Standard units for environmental studies. | Introduction to Engineering Drawing. Its relevant to the trade.<br>Use of Drawing Board, T-Square, Set Square, Protractor, and other draws Instrument. |
| 2. | Role of Pollution control Equipment Operator the required knowledge base. | Free hand drawing of straight lines, rectangles, squares circles, cones, polygons etc. |
| 3. | Fundamental derived units, limits and tolerances. | Free hand sketching simple solid such as cubes, rectangular blocks, cylinders, and cones etc. and their view when viewed perpendicular to their base as well as axes. |
| 4. | Types, specifications and use of different types of hand tools. | -do- |
| 5. | Specification of drill Tap & Dies; Their use and safety precaution | Free hand sketching with dimension of simple solid such as cubes, rectangular blocks, cylinders, cones etc. |
| 6. | Precision measurements, use of venire micro meter , screw gauge, spherometer etc. | Method of fixing a driver sheet on the board. Layout of drawing sheet, Border line, Title Block. |
| 7. | Rivets, solder & flux. Their composition & effect on metal. Development of sheet into different shapes and forms. | Use of different scales in M.M. Reading of simple Blue prints of Geometrical. |
| 8. | Properties of 'Co[1], A1[1]& insulating material. Resistance, inductance, capacitance & Series & Parallel circuits. | Writing single stroke letters and numbers as per BIS 696-1976 (2nd Revision) |
| 9. | Interfacing sensing devices with the electronic devices. | Geometrical Construction on lines, angles and triangles. |
| 10. | Working principles of vacuum pump, compressors.<br>Calculation, etc. Different units of temp. Absolute and normal temp. Standard temp in air pollution application. | Geometrical construction of polygons.<br>Isometric views of simple solids and hollow objects. |
| 11. | Units of pressure absolute, Pascal kg/cm. head of mercury & water, tort etc. calculation | Geometrical construction on plane curves such as cycloid, Involute parabola, hyperbola, spiral, helix etc. |

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| 12. | Energy calculations and their mechanical equivalence. Mass velocity momentum, force acceleration | Orthographic views of simple objects by 1st angle projection. |
| 13. | Density & specific gravity. Density of water at different temperatures. | Orthographic views of simple objects by 3rd angle projection |
| 14. | Chemical bonding oxidation- Reduction of acids & bases. | Exercises on orthographic views of simple solid and hollow objects. |
| 15. | Determination of concentration of solution by % volume | Drawing othographic views of nuts, bolt and screws. |
| 16. | Determination of concentration by molarity<br>Change in weight by heat, drying, ignition combustion etc. | -do-<br>Drawing orthography views of thread farms rivet heads |
| 17. | Determination of atomic weight molecular wt., & equivalents weight | Calculation of triangles, polygons with the aid of trigonometry |
| 18. | Theory of bound & free electron. Electron flow & polarity | -do - |
| 19. | Introduction to microbiology | Free hand sketching of simple objects related to the trade and preparation of simple working drawings from sketches. |
| 20. | Identification of micro organism. Sterilization | -do - |
| 21. | Law of multiple proportions. Law of masses. | Further practice blue print reading and exercises related to the trade. |
| 22. | Theory of oil analysis, PH & buffer solution | Drawing of different types of keys, couplings, rivet heads and thread for us. |
| 23. | Calculation of analysis results. | Drawing different types of loading devices such as double nut, castle nut, pin etc. |
| 24. | Practical calorimetric method.<br>Combustion of fuel calorimetric effect. | Sectional views of simple objects such as brackets, couplings. |
| 25. | Determination of size of microorganisms & thermal death time | Free hand drawing of instruments related with measurement of temperature, pressure, level and flow |
| 26. | Determination of equivalent molecular weight by orsat apparatus& other calculation. | Free hand drawing of instruments related with measurement of temperature, pressure, level and flow |

| BT – II | | |
|---|---|---|
| **Sl. No.** | **Workshop Calculation and Science (Duration: - 20 hrs.)** | **Engineering Drawing (Duration: - 30 hrs.)** |
| 1. | Study of number systems, logic systems classification and uses of computer system. | The circuit diagram of A/C motor single phase with starter.<br>The circuit diagram of three phase A/C motor with starter. |
| 2. | Design of circuit diagram for the following:<br>a) Too and fro motion of double acting cylinder.<br>b) Speed regulation<br>c) Time dependent reversal<br>d) Coordinated motion control for two & three cylinders.<br>Study of the safe use of the equipment used for pollution control and their hazards. | Circuit of the different parts of power supplies related to the trade. |
| 3. | Design the circuit diagram for the following:-<br>a) Control of SA & DA cylinders<br>b) Automatic return<br>c) Oscillating circuit<br>d) Latching circuit | Circuit of the different parts of power supplies related to the trade. |
| 4. | Working principles of circuit diagram hydraulic jack. Design for different of hydraulic circuits amplifying<br>a) Regenerative circuit<br>b) Sequence circuit with limited clamping pressure<br>c) Speed control circuit | Circuit with cascaded system as used in the trade practice. |
| 5. | Design of electro hydraulic circuits<br>a) Automatic return of DA cylinder<br>b) Sequencing of two DA cylinders<br>c) Two hand control for safety of operation. | -do- |
| 6. | Analysis of raw water samples study of physical and chemical properties, like –<br>a) PH<br>b) BCD<br>c) CCD<br>d) Conductivity<br>e) Colour<br>f) Physical appearance<br>Principle and instrumentation of UV-VIS | Block diagram of oscillator symbols for different wave shapes-square saw-tooth, sine, triangular etc.<br>Basic oscillator circuit |

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| | spectrophotometry & atomic absorption spectrophotometry | |
| 7. | Principal and instrumentation of Ion selective electrodes<br>Desirable limits of 20 characteristics.<br>Tolerance limit. Effects on human health | Study of different chromatographic charts. |
| 8. | Tolerance limits for industrial effluents as per IS: 2490.<br>Pt-I-1981 (Cheek list to be made 29 characteristic) | Study of different chromatographic t charts. |
| 9. | Concept of air requirement & Co2 generated. | Drawing of different logic gate circuits FLIP-FLOP and counters |
| 10. | Fuel efficiency calculation | -do- |
| 11. | Concept of Heat release rate and effective stack height. | The flow chart of Micro-Processor |
| 12. | Conversion of NE to NO2 in atmosphere & its harmful effects. | The block diagram of micro processor computer. |
| 13. | Centrifugal &Centripetal forces generated in a rotating machine | Graphic BIS symbols for the chemical parameter, gas parameter, solid parameter to be considered in trade. |
| 14. | Calculation of dust burden on electro-static precipitators. | Graphic symbols for fluid power systems. |
| 15. | Chemical reactions in atmosphere with CFC | Pneumatic working element drawing of direction control valve, pressure control valve and time dependent valve. Design of pneumatic circuit-speed regulations-time dependent |
| 16. | Conversion of waterheadto pressure | Design of pneumatic circuit |
| 17. | Calculation of ground level concentration | Pneumatic circuit related to the trade. |
| 18. | Calculation of stack gas velocity. | Electro-pneumatic working elements-solenoid valves, limit switch, pressure switch, proximity switch, timer & relays. |
| 19. | Calculation of attack gas velocity. | Design of electro pneumatic circuit:<br>a) Oscillation circuit<br>b) Latching circuits related to the trade. |
| 20. | Determination of concentration of gaseous pollinations by titration. | Free hand sketch of hydraulic jack. |
| 21. | Operation & maintenance of temperature controllers | Free hand drawing of pipe joints and fittings. |
| 22. | Calibration of analyzer. | Free hand drawing of shaft coupling and flanges etc. |
| 23. | Forging of sampling line. | Free hand drawing of valves such as |

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| | Calibration of analyzer. Composite system for continuous monitoring of CO, $SO_2$, $NO/NC_x$<br>Control of noise pollution by vent silencer. | gate, ball, needle, diaphragm& control valve. Drawing sketches of pumps such as centrifugal pump, gear pump.<br>Drawing sketches of pumps such as piston pump, plunger, sliding valve and vacuum pump.<br>Design & draw-plan & Section all elevation of bar screen. |
| 24. | Construction & working of various types of valves.<br>Different process of metal joining, bolting riveting, soldering, brazing. | Design & draw elevation & plan view of neutralization tank.<br>Design & draw the plan and elevation view of flow equalization tank. |
| 25. | Calibration of analyzer | Drg. of Diff. types of pipe line diagram, pipe fitting symbols. |
| 26. | Constitution of central & state pollution control board. Constitution of committees. | Design & draw the elevation, plan view of activated sludge tank |
| 27. | Rules to regulate environmental pollution. Power to give direction etc. design of sedimentation tank aeration tank. Solid waste & its treatment/disposal methods. Safety indifferent plants. Gas effluent & its treatment/disposal methods. | Draw the plan & elevation view of chlorination tank. Draw the sludge thickener & mixing tank. Draw the plan & elevation of sludge drawing tank. Free hand drawing of cyclone dust collector and multi cyclone dust collector. |
| 28. | Study of different reports. | -do- |

## 9.2 EMPLOYABILITY SKILLS

**(DURATION: - 110 HRS.)**

| **BT – I (Duration – 55 hrs.)** | |
|---|---|
| **1. English Literacy** | Duration: 20 Hrs.<br>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<br>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.<br>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.<br>Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets. |

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| **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),<br>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.<br>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.<br>Marks : 07 |
| **Introduction to Communication Skills** | Communication and its importance<br>Principles of Effective communication<br>Types of communication - verbal, non verbal, written, email, talking on phone.<br>Non verbal communication -characteristics, components-Para-language<br>Body language<br>Barriers to communication and dealing with barriers.<br>Handling nervousness/ discomfort. |
| **Listening Skills** | Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.<br>Triple- A Listening - Attitude, Attention & Adjustment.<br>Active Listening Skills. |
| **Motivational Training** | Characteristics Essential to Achieving Success.<br>The Power of Positive Attitude.<br>Self awareness<br>Importance of Commitment<br>Ethics and Values<br>Ways to Motivate Oneself<br>Personal Goal setting and Employability Planning. |
| **Facing Interviews** | Manners, Etiquettes, Dress code for an interview<br>Do's & Don'ts for an interview. |
| **Behavioral Skills** | Problem Solving<br>Confidence Building<br>Attitude |
| **BT – II<br>(Duration – 55 hrs.)** | |
| **4. Entrepreneurship Skills** | Duration: 15 Hrs.<br>Marks : 06 |
| **Concept of** | Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue |

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| **Entrepreneurship** | 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, 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.<br>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.<br>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.<br>Accident Prevention techniques - control of accidents and safety measures. | |

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| **First Aid** | Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person. |
| **Basic Provisions** | Idea of basic provision legislation of India.<br>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.<br>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.<br>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** | Ideaof 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: -

**OJT - I**

1. Identify various sources of pollution, its causes & effect on environment & humanity.
2. Identify, operate, maintain & troubleshoot AC Power line, AC motors & Pumps.
3. Measure process variables like temperature, pressures, flow, level etc. by respective process instruments.
4. Prepare and assist in the volumetric analysis as well as in use of microscope.
5. Detect the pollutant samples and report for necessary control.

**OJT - II**

6. Operate electronic measuring and sensing instruments, pneumatic and electro pneumatic controls, hydraulic & electro hydraulic controls.
7. Utilize analyzer of various types viz.COD, BOD, PH, ION, $SO_2$, CO, NO/$NC_X$ and Oxygen etc.
8. Identify boilers and their various controls including precipitators, recycling systems and dust suppressors.
9. Identify, select, operate & maintain various pollution monitoring instruments needed for pollution control.

**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

| OPERATOR CUM MECHANIC POLLUTION CONTROL EQUIPMENT | | | |
|---|---|---|---|
| **List of Tools & Equipments for Basic Training** | | | |
| **S No.** | **Name of the Tools and Equipment** | **Specification** | **Quantity** |
| **i) GENERAL MACHINERY& SHOP OUTFIT** | | | |
| 1. | Digital balance | LCD /LED display accuracy: 0.1mg, capacity 200 Gms. | 5 nos. |
| 2. | Balance (tech.) | LCD /LED display accuracy: 1gm, 1gm to 10 kg capacity. | 1 no. |
| 3. | Auto-clave electrically heated | Capacity: 55 lit, Material: SS 304, pressure gauge, temp. range 121 to 125 $^{o}$C, temp. accuracy ±0.5% with auto cycle controller and solenoid valve foot lifting and drum. | 1 no. |
| 4. | Vacuum pump mounted on moving tables | 0.5 HP electrical motor cap: 50 LPM /2 CFM, oil cooled | 2 nos. |
| 5. | Electric drying ovens | Working temp:200°C size: 450*450*450 mm, inner SS chamber and outer body M.S powder coated and controlled by PID Controller and Air circulation facility. | 2 nos. |
| 6. | Water baths 6 places, electrically heated | Double Walled with Digital controller cum indicator with Stirring Arrangement inside stainless Steel Temp. Range Amb, +5deg.c. To 95. deg.c.+/-0.2 | 4 nos. |
| 7. | Sand bath | | 1 no. |
| 8. | Refrigerator(Deep Freezer Double Door Type) | Single door, Auto defrosting. 200-liter capacity made up of complete S.S. | 1 no. |
| 9. | Chromatographic equipment | Paper, column, thin layer Column Type Chromatographic Equipment: Gas Chromatograph, The Gas Chromatograph should be Microcontroller based system | 1 no. |

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| | | with oven, PLC based pneumatic module, temperature controller cum programmer module, FID and TCD Module, PC based Data station and also remote display unit for displaying concentration of one key component of the sample via RS 485 port, Windows based single channel software, With All accessories.<br>Liquid Chromatographic Equipment:<br>With Solvent delivery system, Injector, UV – VIS detector, HPLC column: | |
| 10. | Stirrers with motors | 230V, AC, capacity 5 - 7 liters with regulator | 8 nos. |
| 11. | Magnetic stirrers (with heating plate) | 2 liters capacity with heating coil | 2 nos. |
| 12. | Mortar | 100 mm, porcelain with pestle | 6 nos. |
| 13. | Heating plates (electric) | 1000 watt | 1 no. |
| 14. | Mortar & pestle | 150 mm. steel / cast iron | 1 no. |
| 15. | Electric heating plates | With C.I top 16 “x18 “size and regulator | 2 nos. |
| 16. | Heating mantles (universal) | | 6 nos. |
| 17. | Borer for stoppers with sharpener | | 1 no. |
| 18. | Clamps with spring or screw | | 16 nos. |
| 19. | Cork press | | 1 no. |
| 20. | Scissors | | 2 nos. |
| 21. | Bunsen's burner | | 16 nos. |
| 22. | Set sieves automatic | 20 – 200 mesh | 1 no. |
| 23. | Shaking machines for sieves & bottles | | 1 no. |
| 24. | Steam generator (copper) for steam distillation | 2 liters | 10 nos. |
| 25. | Hot water funnel with thermometer | 1liter, 0 to 110 *C | 10 nos. |
| 26. | Tongs (forceps) nickel for crucibles & weights | | 16 nos. |
| 27. | Tongs long for crucibles (muffle furnace) | | 6 nos. |
| 28. | Spatulas nickel | | 20 nos. |

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| 29. | Test tube stand | For 10 - 12 test tubes | 16 nos. |
| 30. | Tripods | | 16 nos. |
| 31. | Test tube holders | | 16 nos. |
| 32. | Clamp holders | | 16 nos. |
| 33. | Clamps(Forced Head) | | 16 nos. |
| 34. | Retort Rings with clamps for filtering & heating | | 16 nos. |
| 35. | Stands Burret | | 16 nos. |
| 36. | Stands with clamps for burettes | | 16 nos. |
| 37. | Apparatus for distilled water and demineralizing water | Cap: 10 liter/hr, made of S.S with water level cut off | 1 each |
| 38. | Crucible nickel | 30 mm. dia, height 40 mm., | 6 nos. |
| 39. | One pan analytical balances | 0.1mg. To 100 Gm. Sensibility | 5 nos. |
| 40. | LCD Multimedia projector | | 1 no. |
| 41. | Computer (latest configuration) with licentiate operating software. | | 1 no. |
| 42. | Printer (Printer, Scanner & Copier) | | 1 no. |
| 43. | Microscope | x 1000 (Monocular) | 1 no. |
| 44. | Polariometers with extra sodium lamp | Optical wavelength of 589nm, Measuring range of ± 89 Deg., Accuracy of 0.01- 0.002º Temperature range of 0-40 Deg C (accuracy +/- 0.1 Deg C) Response speed of +/- 6°/sec | 2 nos. |
| 45. | Refractometers (Abbe type with refractive index) | Range of measurement nD 1.3000 – 1.7000, scale reading +0.001 and 0.0001 by estimation, Sugar scale 0.95% (+0.5%), Dispersion of nD + 0.0005 | 1 no. |
| 46. | pH meter Digital | With PH Range of 1 -14, Resolution of 0.01 pH, Temperature Range up to 0.0oC to 100oC, Digital LED/LCD Display, Power Supply of 230VAC ±10%, with auto calibration facility, auto manual temp., compensation facility, PH Electrode. To study the measurement of PH. | 1 no. |

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| 47. | Potentiometric titration apparatus | Range: 0 to+ 1999.9mV<br>Resolution: 1 mV | 1 no. |
| 48. | Conductivity meter | Microprocessor based, Auto ranging, Automatic End point function, LCD display, Accuracy ±1% F.S., up to 3 point calibration, Reset function, conductivity buffer option, Hold and Auto off function, temperature compensation. | 1 no. |
| 49. | Orsat's Apparatus with glassware | | 1 no. |
| 50. | Karl Fisher apparatus for moisture determination | Sample size: 1 - 50 mg of water<br>K. F. Dispensing resolution: 0. 05 ml. fully automatic. | 1 no. |
| 51. | Apparatus for determination of flash point | This apparatus is made as per IP 34, ASTMD-93 and IS 1448 (Part I) 1270 (P.21) and IS 1209-1953 method B. | 1 no. |
| 52. | Melting point apparatus | Made up of S.S. with 1% accuracy. 0.5 deg. C, with range up to 360 deg. C, temp. set point facility, digital display. | 1 no. |
| 53. | Electrolytic analyzer | Analyzer for analysis of (i) Hydrogen (ii) Nitrogen (iii) Sulphur (iv) Chlorine employing electrode / induction furnace along with sensor/detectors. | 1no. |
| 54. | Photo-colorimeter | With Wave length of 400nm to 700nm, Resolution of 0.01A, LED light source and display, Accessories like Cuvettes, Operation Manual, Cover | 1no. |
| 55. | Bourdon Tube Pressure Gauges Different Ranges | 100 mm dia, S.S. body, range: 6,10,20,30 kg/cm^2 | 2 each |
| 56. | Compound Gauge | 100 mm dia, S.S. body | 2 nos. |
| 57. | Diaphragm Type Pressure Gauge | With Dial Size of 150 mm, | 2 nos. |
| 58. | Spectroscopy-IR/NMR/UV-Visible Spectrophotometer, FTIR | UV-Visible Spectrophotometer: double beam wave length 190-1100 Nm, USB data output port LCD display, D2 lamp & tungsten | 2 nos. |

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| | | lamp, printer port, multifunction software highly accurate silicon photo diode detector. | |
| 59. | Dead Weight Tester with Accessories | Range of 0 kg/ cm2 to 7 kg/ cm2, S.S. Sensing Element, Top & Bottom Chamber, Movement Case. To study the measurement of pressure. | 1no. |
| 60. | Heating plate (electric) | 1000 watt | 4 nos. |
| 61. | Pressure regulating Valve | | 2 nos. |
| 62. | Oswald viscometer (Consumable) | MOC: Borosilicate Glass<br>Size: 120X1 mm<br>Overall height: 237 mm<br>Ready to use. | 3 pieces |
| 63. | Redwood viscometer | As per IS 1448 & IP 70 with stop watch & thermometers. | 3 pieces |
| 64. | Stop watch (Digital) | $1/10^{th}$ Sec. | 6 pieces |
| 65. | Thermostatic bath | Made up of 300 x 250 x 100 mm, double wall construction inner being of stainless steel outer of M.S. duly storing paint finish and gap filled to temperature insulation with glass wool 6 holes of 75 mm dia, 8 Ltr. Ready to use. | 2 pieces |
| 66. | Specific gravity bottle | MOC: Borosilicate Glass | 6 nos. |
| 67. | Pyknometer10ml | Made up of anodized aluminum or S.S. | 6 nos. |
| 68. | Spirit level | | 3 sets |
| 69. | Different types of levers | | 1 set |
| 70. | Barometer | | 1 no. |
| 71. | Wet and dry bulb thermometer | Made up of S.S. with water filling facility. | 2 sets |
| 72. | Apparatus for measurement of coefficient of expansion (thermal) of solid and liquid. | It will consist of a half-meter long chromium plated rod, Steam prepared in copper steam boiler of 2-liter capacity, 2 Thermometers, 1 hot plate of 1kw. Ready to use. Mounted on Suitable Frame Structure. | 2 sets. |
| 73. | Apparatus for measurement of thermal conductivity of good and bad conductor | Made up of S.S. with heater assembly of 1000 watt, 300 mm (D) test specimen, 8 J type sensors, Dimmer state, Voltmeter and Amperemeter & Temperature | 2 sets |

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| | | indicator. | |
| 74. | Calorimeter for determining mechanical equivalent of heat and specific heat. | | 4 sets. |
| 75. | Polarimeter with monochromatic light (with extra sodium lamp 35W) | Touch screen color display, temperature display, measuring mode, optical rotation, specific rotation, sugar, concentration, measuring range: - 45 deg to 45 deg, LED light source.<br>Ready to use instrument. | 2 sets |
| 76. | Abbe refractometer (Digital) | With Range of measurement nD 1.3000 – 1.7000, Sugar scale 0.95% (+0.5%), Dispersion nD + 0.0005, LCD Display, printer interface.<br>Ready for experiment. | 2 sets |
| 77. | Equipment to study Kirchhoff's law and Electrochemical equivalent | | 1 set |
| 78. | Whetstone's bridge | | 2 sets |
| 79. | Resistance box | 0 to 100 ohms | 2 nos. |
| 80. | Resistance box (1,2,5,10 Ω) | 0 to 500 ohms. | 2 nos. |
| 81. | Rheostat0-25 Ohms | 25 Ohms | 2 nos. |
| 82. | Rheostat0-100 ohms | 100 Ohms | 2 nos. |
| 83. | Rheostat | 500 Ohms | 2 nos. |
| 84. | Ammeter | 0 to 1 Amp (DC) | 2 sets |
| 85. | Ammeter | 0 to 5 Amp (DC) | 2 sets |
| 86. | Ammeter | 0 to 10 Amp (AC, DC) | 2 sets |
| 87. | Ammeter | 0 to 30 Amp (AC, DC) | 2 sets |
| 88. | Volt meter | 0 to 1 volt (DC) | 2 sets |
| 89. | Volt meter | 0 to 4 volt (DC) | 2 sets |
| 90. | Volt meter | 0 to 5 volt (DC) | 2 sets |
| 91. | Volt meter | 0 to 10 volt (DC) | 2 sets |
| 92. | Volt meter | 0 to 25 volt (DC) | 2 sets |
| 93. | Volt meter | 0 to 50 volt (DC) | 2 sets |
| 94. | Milli voltmeter | 0 to 5 mV | 2 nos. |
| 95. | Milli voltmeter | 0 to 50 mV | 2 nos. |
| 96. | Digital Milli voltmeter | 0 to 200mv | 2 nos. |
| 97. | Resistance coils | 5 Ohms, 10 Ohms, 50 Ohms, 100 Ohms | 2 sets |
| 98. | Digital Viscometer | Measuring range in mpa/Cp,LED display/LCD, with diff | 2 nos. |

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| | | Measurement with 4 spindles, provided with RS 232 C interface. Ready for use instrument. | |
| 99. | Comparator (Visual Colorimeter) | Measuring principle visual, Visual measurement of colour matching to determine material colour, Replaceable sample chamber liner, Transmittance and reflectance modes, Measurement range: 0.1-79.9 Red, 0.1-79.9 Yellow, 0.1-49.9 Blue, 0.1 – 3.9 Neutral, used for to measure colority of liquid, solid and powder sample. | 02 nos. |
| 100. | Automatic Titration Apparatus | Display 16 character x 2 lines Alphanumeric BL LCD Ready for use instrument. | 02 nos. |
| 101. | Gas fuming chamber with exhaust | Made up of S.S chamber min 4'x2'x2'with air exhaust and working platform of S.S. sheet, It will be designed so as to throw-out all toxic/harmful vapours & fumes, Working Table top is acid/alkali resistant, 6 mm thick Front facing door with toughened glass, the unit will be fitted with fluorescent light and a gas cock, and Drain valve. | 01 no. |
| 102. | Furnace 1200$^{o}$ C | Range: 1100 deg Made up of M.S. 12”X6”X16” size, Muffle ovens 1100 deg. C, PID, sensor, with proper insulation. | 01 no. |
| 103. | Fire Extinguisher | Chemical Foam type | 01 no. |
| 104. | Sand Bucket set | | 01 no. |
| 105. | LPG Cylinder | | 01 no. |
| 106. | Water testing kit (all parameters) | Measuring range: Ph (0 to 14 Accuracy +/-0.01), TDS, Conductivity, Temperature And DO, read out: LCD manual with all necessary Electrodes/probes to measure above parameters, and with electrode stand with holding clamp buffers, sample containers minimum 5, semiconductor probe Instrument | 01 set |

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| | | Will be in Ready to Use (in carrying case) Condition. | |
| 107. | Air Conditioner | 2 Ton | 02 nos. |
| **B. CONSUMABLE GLASSWARE AND MISCELLANEOUS** | | | |
| 108. | Desiccators | 150 mm. dia. | As Required |
| 109. | Desiccators vacuum | Borosilicate glass | As Required |
| 110. | Extraction thimbles | | As Required |
| 111. | Glass tubes & rods of different diameter | Borosilicate glass | As Required |
| 112. | Rubber tubes for water, gas & vacuum, stopper, rubber each glass, plastic & cork of different sizes | | As Required |
| 113. | Asbestos wire gauge | | As Required |
| 114. | Wire gauge (without asbestos) | | As Required |
| 115. | Cork rings | | As Required |
| 116. | Pipe clay Triangles | | As Required |
| 117. | Erlenmeyer flasks | 250 ml. | As Required |
| 118. | Erlenmeyer flasks | 500 ml. | As Required |
| 119. | Burettes | 25 ml. | As Required |
| 120. | Burettes | 50 ml. | As Required |
| 121. | Pipettes Volumetric | 10 ml. | As Required |
| 122. | Pipettes Volumetric | 25 ml. | As Required |
| 123. | Pipettes measuring | 0 to 5 ml. | As Required |
| 124. | Pipettes measuring | 0 to 10 ml. | As Required |
| 125. | Pipettes measuring | 0 to 1 ml. | As Required |
| 126. | Pipettes | micro 0 to 0.2 ml. | As Required |
| 127. | Pipettes | 1ml. (graduated) | As Required |
| 128. | Each pipettes automatic | 1, 2, 5, 10 ml. | As Required |
| 129. | Flasks for distilled water | 500 ml. | As Required |
| 130. | Vacuum pipettes | Borosilicate glass | As Required |
| 131. | Measuring cylinders | 25 ml. Borosilicate glass | As Required |
| 132. | Measuring cylinders | 50 ml. Borosilicate glass | As Required |
| 133. | Measuring cylinders | 100 ml. Borosilicate glass | As Required |
| 134. | Measuring cylinders | 250 ml. Borosilicate glass | As Required |
| 135. | Measuring cylinders | 500 ml. Borosilicate glass | As Required |
| 136. | Measuring cylinders | 1000 ml. Borosilicate glass | As Required |
| 137. | Volumetric flask | 100 ml. Borosilicate glass | As Required |
| 138. | Volumetric flask | 250 ml. Borosilicate glass | As Required |
| 139. | Volumetric flask | 500 ml. Borosilicate glass | As Required |
| 140. | Volumetric flask | 1000 ml. Borosilicate glass | As Required |
| 141. | Weighing bottles | polyethylene or glass 50 ml. | As Required |

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| 142. | Weighing bottles | polyethylene or glass 100 ml. | As Required |
| 143. | Funnels with regular & long stem | 7 cm. dia. Borosilicate glass | As Required |
| 144. | Funnels | 4 cm. dia. Borosilicate glass | As Required |
| 145. | Funnels | 9 cm. dia. Borosilicate glass | As Required |
| 146. | Funnels Buchner different sizes | 10 to 25 cm. dia. Borosilicate glass | As Required |
| 147. | Funnels Hirsch | 10 cm. Borosilicate glass | As Required |
| 148. | Funnels separatory | 50 ml. Borosilicate glass | As Required |
| 149. | Funnels separatory | 100 ml. Borosilicate glass | As Required |
| 150. | Funnels separatory | 250 ml. Borosilicate glass | As Required |
| 151. | Funnels separatory | 500 ml. Borosilicate glass | As Required |
| 152. | Funnels for filter crucibles & Gooch crucibles with rubber rings | Borosilicate glass | As Required |
| 153. | Beakers | 100 ml. Corning Borosilicate glass | As Required |
| 154. | Beakers | 250 ml. Corning Borosilicate glass | As Required |
| 155. | Beakers | 400 ml. Corning Borosilicate glass | As Required |
| 156. | Beakers | 600 ml. Corning Borosilicate glass | As Required |
| 157. | Beakers | 1000 ml. Borosilicate glass | As Required |
| 158. | Watch glasses | 5 cm. dia. | As Required |
| 159. | Watch glasses | 7.5 cm. dia. | As Required |
| 160. | Watch glasses | 10 cm. dia. | As Required |
| 161. | Dishes evaporating | 5 cm. dia. porcelain, glass | As Required |
| 162. | Dishes evaporating | 7.5 cm. dia. | As Required |
| 163. | Dishes evaporating | 10 cm. dia. flat bottom | As Required |
| 164. | Dishes evaporating | 15 cm. dia. | As Required |
| 165. | Dishes evaporating | 20 cm. dia. | As Required |
| 166. | Thermometers | 0 to 110°C | As Required |
| 167. | Thermometers | 0 to 250°C | As Required |
| 168. | Thermometers | 0 to 350°C | As Required |
| 169. | Thermometers for drying oven (L shape) | | As Required |
| 170. | Boiling flasks with round bottom | 100ml. Borosilicate glass | As Required |
| 171. | Boiling flasks with round bottom | 250ml. Borosilicate glass | As Required |
| 172. | Boiling flasks with round bottom | 500ml. for each distilling flasks 50 ml., 100 ml., 250 ml. Borosilicate glass | As Required |
| 173. | Boiling flasks with round bottom | 500ml. for each distilling flasks 50 ml, 100 ml, 250 ml - Writz and others, Borosilicate glass | As Required |
| 174. | Filtering flasks | 250 ml. Borosilicate glass | As Required |

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| 175. | Filtering flasks | 500 ml. Borosilicate glass | As Required |
| 176. | Filtering flasks | 1000 ml. Borosilicate glass | As Required |
| 177. | Flasks soxhlet with condensers | Borosilicate glass | As Required |
| 178. | Flasks kjeldahl | 250 ml. Borosilicate glass | As Required |
| 179. | Condensers liebig | 30 mm. long, Borosilicate glass | As Required |
| 180. | Condensers liebig | 50 cm. long, Borosilicate glass | As Required |
| 181. | Condenser bulb type | 30 cm. long, Borosilicate glass | As Required |
| 182. | Condenser spiral type | 20 cm. long, Borosilicate glass | As Required |
| 183. | Connecting tubes for Kjeldahl distillation | | As Required |
| 184. | Gas generator (Kipp) | 500 ml. (plastic) | As Required |
| 185. | Gas washing bottles (Drechsler) | | As Required |
| 186. | Drying tubes with one bulb (Calcium chloride) | | As Required |
| 187. | Crucibles porcelain | 5 cm, dia, height 4 cm indigenous | As Required |
| 188. | Crucibles quarts | 5 cm, dia, height 4 cm indigenous | As Required |
| 189. | Gooch porcelain or glass | | As Required |
| 190. | Filtering crucible | No. 0, 1, 2, 3 glass | As Required |
| 191. | Test tube | 160 mm x 15 mm. | As Required |
| 192. | Test tube | 10 mm. | As Required |
| 193. | Gas sampling tubes | | As Required |
| 194. | Pairs nessler tubes | | As Required |
| 195. | Tubes for centrifuge | | As Required |
| 196. | Bottles with droppers for indicator solutions & semi-micro qualitative analysis | 30 ml. | As Required |
| 197. | Bottles with droppers for indicator solutions & semi-micro qualitative analysis | 50 ml. | As Required |
| 198. | Bottles for solids | 50 ml. | As Required |
| 199. | Bottles for solids | 100 ml. | As Required |
| 200. | Bottles for solutions | 100 ml. | As Required |
| 201. | Bottles for solutions | 250 ml. | As Required |
| 202. | Bottles for solutions | 1000 ml. | As Required |
| 203. | Bottles for solutions | 2000 ml. | As Required |
| 204. | Bottles for solutions | 3000 ml. | As Required |
| 205. | Bottles for solutions | 5000 ml. | As Required |
| **C. SAFETY** | | | |
| 209. | Apron | White | As Required |
| 210. | Hand Gloves (Nitrile) | | As Required |
| 211. | Acid Alkali Goggles | | As Required |
| 212. | Nose Mask (Cotton) | | As Required |
| 213. | Ear Plug | | As Required |

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| 214. | Particle Size Analyzer | Capable of measuring a wide range of particle size distributions, Measurement range: 17 nm to 2500 µm, Light source: Red semiconductor laser (680 nm wavelength) | As Required |
| 215. | Solid Analyzer | Casting: rugged all-metal with integral handles, Spectral range 3700 to 15000 $cm^{-1}$, Resolution better than 0.7 $cm^{-1}$, Frequency accuracy (@7300 $cm^{-1}$):< 0.06 $cm^{-1}$, Ethernet port for data communication. | As Required |
| 216. | Surface Area Analyzer | Automatic calibrationfacility, Capable to create Automatically necessary mixtures of nitrogen and helium, Detector protection, Electronic valves, software control the unit via USB communication. | As Required |
| ***Note: -*** *All the tools and equipment are to be procured as per BIS specification.* | | | |

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

**TRADE: OPERATOR CUM MECHANIC POLLUTION CONTROL EQUIPMENT**

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

| 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 FORMATIVE 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 :** | **Examination:** | | **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 formative assessment Marks** | **Result (Y/N)** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Maximum Marks (Total 100 Marks)** | | | **15** | **5** | **10** | **5** | **10** | **10** | **5** | **10** | **15** | **15** | | |
| **1** | | | | | | | | | | | | | | |
| **2** | | | | | | | | | | | | | | |