ADVANCE MECHANIC (INSTRUMENTS)

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – INDUSTRIAL AUTOMATION AND INSTRUMENTATION

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

ADVANCE MECHANIC (INSTRUMENTS)

(Revised in 2018)

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NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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ACKNOWLEDGEMENT

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

1. Air India Ltd., Hyderabad
2. HAL, Hyderabad
3. M/s. Polmon Instruments Pvt. Ltd., Hyderabad
4. Nuclear Fuel Complex, Hyderabad
5. Voith Turbo, Hyderbad
6. Hindustan Flurocarbon Ltd., Hyderabad
7. NVIS Technologies, Hyderabad
8. Scientech Technologies P. Ltd., Hyderabad
9. ECIL, Hyderabad.
10. Bharat Electronics Ltd., Hyderabad.

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

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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.

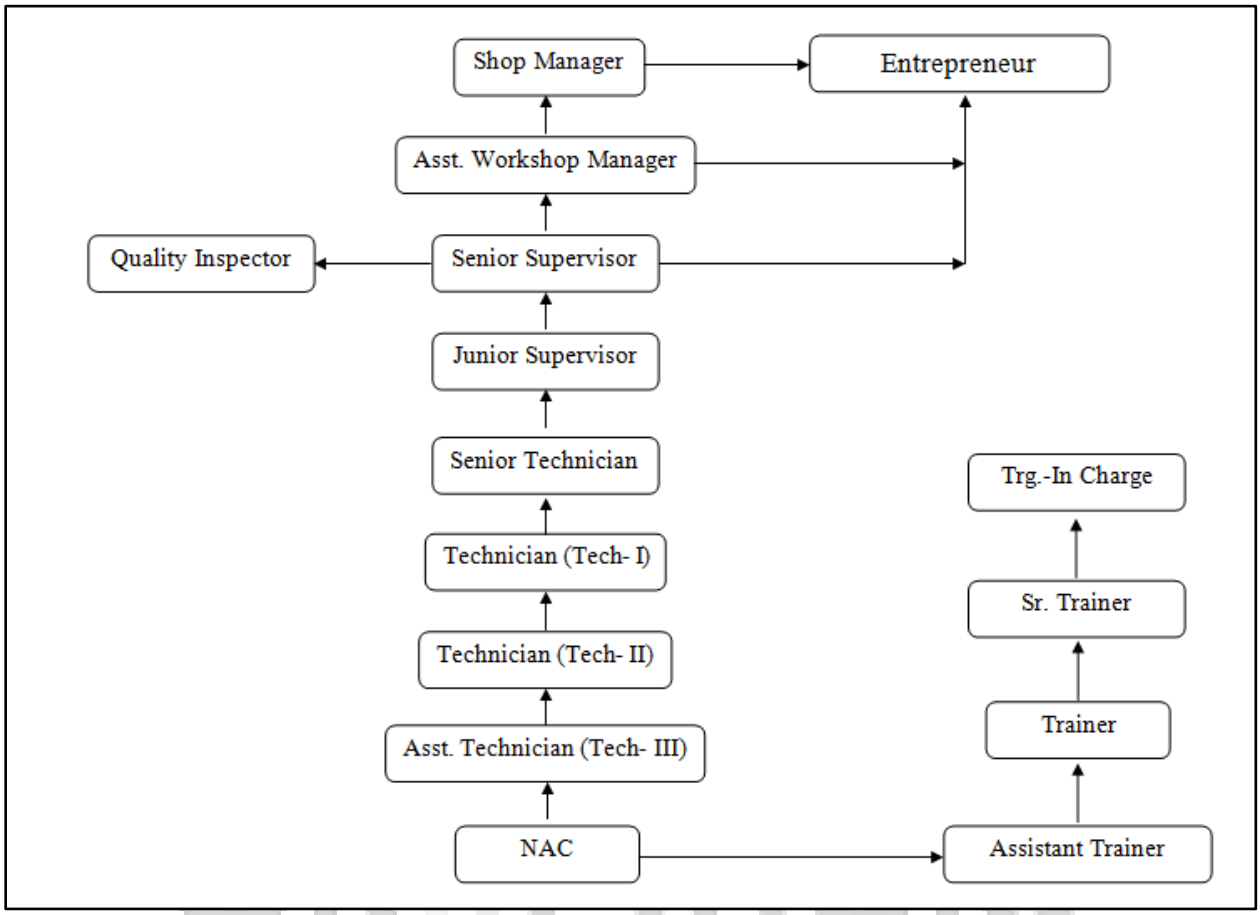
Advance Mechanic (Instruments) trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills 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 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 • 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:

Mechanic Precision Instrument, General Mechanic, Precision Instrument General tests, repairs, overhauls and assembles various precision instruments and their parts for efficient performance. Examines instrument for defects. Dismantles components and cleans them in appropriate fluid such as petrol, kerosene etc. to find out extent of damage or wear and tear to parts. Removes minor defects of parts by grinding, filing, drilling, etc. and replaces worn out and damaged parts. Adjusts position of various parts using screwdriver, spanner etc. and assembles instrument to form complete unit. Makes simple electrical connections, solders contact points and performs other tasks as necessary. Tests performance either by visual observation or by conducting simple electrical and mechanical tests and ensures that repaired or assembled instrument conforms to prescribed efficiency. May make new components and assemble new instruments. May specialize in any particular type of instrument like mechanical, hydraulic, pneumatic, electrical, optical, orthopedic etc.

Technician Instrumentation Technician Instrumentation dismantles removes and replaces a range of instruments and faulty peripheral components down to unit and component level, setting up test equipment, troubleshooting components of instruments, calibrating them and also preparing service reports and accurately documenting parts replacement and repair.

Mechanic Precision Instrument, Mechanical Mechanic Precision Instrument, Mechanical makes, alters and adjusts mechanical instruments or mechanical parts of electrical and optical instruments by accurate milling, filing, grinding, lapping and other processes. Studies drawings or samples and examines precision instrument like balance, meters, pressure gauges etc. for defects. Dismantles instrument, cleans metal components in petrol, kerosene oil or otherwise and checks them to find out extent of damage and further serviceability. Makes new parts on lathe milling or other machines, if necessary. Sizes and fits metal parts by filing, scraping, grinding lapping etc. as necessary and ensures their desired accuracy by checking with precision measuring instruments shadow graph and other highly perfect devices. Assembles parts to form complete unit. Gets electrical components repaired by Electrician. Fits electrical and optical parts to instrument and adjusts them as required. Texts repaired or assembled instrument for clarity or vision sensitivity, correct meter and scale readings etc. as required and ensures stipulated performance within prescribed limits. Makes necessary adjustments and seals meters to avoid manipulations. May specialize in particular type of instruments like balance, pressure gauges, meters, the odolites, etc. May make new instruments from blue prints.

Functional Tester is responsible for checking functions of manufactured industrial equipment such as UPS, inverter, energy meter, PLC, oscilloscope, control panel. The individual at work tests specified functions of every product being assembled on the production line.

Calibrator (Instrument and Apparatus) tests and calibrates controlling, indicating, and measuring instruments and devices, such as monochromators, pressure regulators,

tachometers, temperature controls, and thermometers, to ensure specified operating performance, using hand tools, testing and calibrating instruments and equipment, and precision measuring instruments: Reads quality control manual and testing specifications to obtain data to test or calibrate specific devices. Selects and installs accessories, such as adapters, indicating gauges, or holding devices on test or calibration fixture, and connects instrument or device to fixture, according to specifications, using hand tools. Sets controls to regulate factors, such as current flow, timing cycle, pressure, temperature, or vacuum, according to specifications, and activates test or calibration equipment. Observes readings on meters and gauges, and other displays and performance of the device or instrument to identify functional defects and determine calibration requirements. Adjusts calibration mechanisms to obtain specified operational performance of the device or instrument, using hand tools and precision measuring and calibrating instruments and equipment. Applies sealing compound on calibration mechanism to prevent readjustment of settings and loss of calibration. Rejects malfunctioning devices and routes devices to specified department for rework or salvaging of parts. May disassemble instrument or device to determine cause of defective operation and notify supervisory personnel of findings.

Calibration Technician sets, adjusts, validates or verifies mechanical, pneumatic, hydraulic, electrical, electronic, measuring and control instruments using reference standards in accordance with predetermined standard procedures.

Mechanic, Precision Instrument, Electrical Mechanic Precision Instrument Electrical; Meter Repairer, Electrical repairs and sets electrical parts of precision instruments such as megger, voltmeter, ammeter, condensers, galvanometers, etc., to high accuracy for recording correct readings by reviving, replacements and necessary adjustments. Studies drawings, circuit diagrams and other specifications and examines instrument visually to locate any apparent loose connection, short circuits etc. Dismantles instrument using insulated screw drivers, pliers, special spanners etc., and checks components, insulation wiring, fittings and other features with precision mechanical and electrical measuring instruments to locate wear and tear, short circuits and other defects. Cleans necessary or any fluid used in instrument and their various parts using special brushes. Checks gear shell, bearing jewels and other operating parts and repairs or replaces worn out and damaged ones. Assembles parts, replaces insulation and makes electrical wiring and connections according to diagram and prescribed specification. Examines assembled or repaired instrument by standard tests, makes necessary adjustments and ensures correct reading and desired performance within prescribed limits. Seals cut-outs, meters etc. to avoid manipulation. May wind coils, set new resistance and perform other electrical functions, if required.

Automation Specialist Individuals at this job are responsible for providing support to production operations through maintenance of process control systems installed at shop floor for various manufacturing processes

Precision Instrument Makers and Repairers, other perform number of low skilled and routine tasks such as dismantling instruments, filing, making connections, operating vacuum machine,

soldering, sealing covers, cleaning lenses etc., and is designated as Instrument Mechanic Mate, Instrument Mechanic Helper.

Instrument Mechanic supports the plant operation and all machines operation is safe & running correctly by conducting inspections and preventive maintenance. His job role involves skilled mechanical and electrical and electronic work such as

- Refer manuals, reading and interpreting circuit diagrams, blueprints and schematics
- inspecting and testing the operation of instruments and systems to diagnose faults using testing devices
- writing maintenance reports
- repairing and adjusting system components or removing and replacing defective parts
- calibrating components and instruments
- performing scheduled preventative maintenance work
- installing control and measurement instruments on existing or new plant equipment
- observing safety in accordance with government and company standards

Reference NCO 2015:

(i) 7311.0100 – Mechanic Precision Instrument, General
(ii) 7311.0101 – Technician Instrumentation
(iii) 7311.0400 – Mechanic Precision Instrument, Mechanical
(iv) 7543.0801 – Functional Tester
(v) 7311.1000 – Calibrator (Instrument and Apparatus)
(vi) 7311.1001 – Calibration Technician
(vii) 7412.0100 – Mechanic, Precision Instrument, Electrical
(viii) 7412.0101 – Automation Specialist
(ix) 7311.9900 – Precision Instrument Makers and Repairers, other

4. NSQF LEVEL COMPLIANCE

NSQF level for Advance Mechanic (Instruments) 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 Advance Mechanic (Instruments) 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	Advance Mechanic (Instruments)
NCO - 2015	7311.0400, 7412.0100
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 10th class 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	01year
CTS trades eligible for Advance Mechanic (Instruments) Apprenticeship	Broad Based Basic Training in Chemical Sector under Centre of Excellence Scheme and Advanced module of Centre of Excellence Scheme in Instruments Mechanic.

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 Advance Mechanic (Instruments) 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 including basic electrical. *[Different mathematical calculation & science –units, Fractions & Simplification, square roots, material science, Ratio &Proportion, Percentage, Work, Power & Energy, Algebra, Mensuration, Trigonometry, Mass, weight, density, Pressure]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, symbolic representation of fastener and pipe joints, Electrical, electronic and digital symbols, P&I drawing symbols ISA 5.1]*
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. Identify personal & plant safety procedures and use of safety equipment.
2. Prepare a Schematic Layout of the process and operation of the plant.
3. Find faults, troubleshoot, calibrate, connect common electrical measuring instruments, Continuity Testers, meggers, earth resistance testers and multi meters etc.
4. Test, connect with devices, start and control and reverse the direction of rotation of DC motors, AC single phase and three phase induction motors, synchronous motors.

5. Interpret electrical (Single line diagrams& MCC Panel wiring) & electronic circuits and its drawings. Test, operate & troubleshoot electronic based circuit.
6. Prepare, cable glanding, crimp, terminate and test various power/instrumentation cables used in industries.
7. Perform different soldering like metal to metal, wire to wire, wires to plugs, wires to connectors, wires to component PCB and de-soldering work.
8. Test basic electrical (MCBs, push buttons, relay, contactors)/electronic components (diodes, transistors, capacitors, coils, resistors etc.) using proper measuring instruments.
9. Configure, install, troubleshoot, upgrade and interconnect given computer system.
10. Test, operate and analyse the basic analog and digital electronic circuits.
11. Test and Operate microcontroller (8051) based systems.

Block – II

12. Identify location of the various sensing element, transmitter, controller, final control valve of a control loop.
13. Demonstrate and apply the mounting arrangements for field & control room instruments (Panel mounting, Wall mounting, Yoke mounting etc.).
14. Examine care, safety and proper use of hydraulic & pneumatic tubing & fittings, coupling and connectors.
15. Carry out Dismantling, Cleaning and Re-assembling of Air-Filters, Air Regulators. Connect pneumatic instruments & adjust as per name plate.
16. Remove and Re-Fit a plant instrument after properly isolating the section of plant. Follow Plant Procedure like SOP work order, clearance Certificates etc.
17. Calibrate and Maintain field instruments (displacement, pressure, flow, level, temperature etc.) and panel instruments (indicator, controller, convertor, recorder) used in instrumentation field.
18. Dismantle, inspect, calibrate and assemble various Control Valves, Valve Positioner, Convertor, various types of final elements and actuators.
19. Install and maintain various types of Control Loops like ON OFF, PID, and feedback control loops etc and components (sensing clement, single indicator/recorder, controller and final control element), relays and annunciator.
20. Familiarize with instrument drawing in sketching; identify instruments symbols and blocks diagrams of existing units in the plant. Check Instrument and Panel Installation as per layout plan.
21. Install and maintain analytical instruments.
22. Install, test and maintain recorders, data loggers.
23. Test and calibrate digital protocol (HART) instruments. Prepare and test networking cables.

24. Operate PLC & HMI. Execute and correct programs in PLC. Check communication of PLC with HMI.
25. Operate DCS & SCADA system in the industry. Check PC interface of intelligent devices.

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, explain different	2.1 Explain concept of basic science related to the

mathematical calculation & science in the field of study apply in day to day work.*[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.]*		field such as Material science - Properties of materials, Ferrous & non-ferrous metals, etc.
	2.2	Mass, weight, Density, Specific Gravity etc.
	2.3	Use scale/ tapes to measure as per specification.
	2.4	Calculate area / volume of the materials.
	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.
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 Advance Mechanic (Instruments)/ 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	**Measuring system's** Handling of all latest instruments volume, pressure, level instruments.	Study of all latest instruments volume, pressure, level instruments,
2	Handling of product catalog, slide shows, transfer sheet	Study of product catalog, slide shows, transfer sheet
3	Handling of control system and final control system.	Study of control system and final control system
4	Application of measuring system.	Application of measuring system.
5-6	**Supervisory control of data acquisition system** Overview of DCS, Architecture-block diagram, field control station, operator station, Features of operator station, Networking with different control stations and operator station, Communication protocol Overview of SCADA System , component of system, PLC (Programmable logic controller) Programming with PLC , HMI- (Human machine meter face) feature of HMI, communication of PLC with HMI, Use of desktop PCs with windows operating system , DCS & SCADA System	Communication protocol Overview of SCADA System Programmable logic controller, Programming with PLC, HMI-(Human machine meter face) feature of HMI (Human machine meter face) feature of HMI, communication of PLC with HMI, Use of desktop PCs with windows (Human machine meter face) feature meter face) feature of HMI, 3) communication of PLC with HMI 4) Use of desktop PCs with windows operating system, DCS & SCADA System
7	Calibration of pressure gauge, vacuum gauge, Temp indicator RTD i/p & Thermocouple i/p, Universal controller, D.P. Transmitter, Control valves - PID ON-OFF with positioned.	Introduction to calibration pressure gauge calibration vacuum gauge , Temp indicator -RTD i/p & Thermocouple i/p, Universal controller, D.P. Transmitter, Control valves - PID ON-OFF with positioned Process indicator - Level, Pressure, pH indicator, Conductivity indicator, weight balance. Study of Solenoid Valve Timers, Dial thermometer I/P Converter Flow meter - Water meter, Voltmeter, Rota meter.
8	Process indicator - Level, Pressure, pH indicator, Conductivity indicator, weight balance Study of Solenoid Valve. Timers, Dial thermometer I/P Converter Flow meter - Water meter, Voltmeter, Rota meter.	
9	Understanding Sensor traducer signal conditioning.	Introduction Sensor traducer, signal conditioning.
10-12	1) **Master instruments** 2) Dead weight tester	Dead weight tester Universal calibration Monometer Master Flow meter

	3) Universal calibration 4) Monometer Master Flow meter 5) Timer 6) Conductivity simulation 7) pH-buffer 8) Standard weight 9) Multi meter analog digital	Conductivity simulation PH buffer simulation PH-buffer Standard weight Multi meter analog digital
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)
1-2	Understanding basic primary element Each type of process parameters (Flow, temp, pressure, level) Brief theory of each primary element Flow - orifice ,Rota meters level -D.P. instrument , displayer type measurement, ultrasonic level measurement, Non contact type Ruder & Radioactive type Pressure -Bourdon tube type, capacitance type, strain gauge type. Temp -thermostats, thermocouple RTD, Field system, bimetallic.	Introduction to basic primary element Each type of process parameters (Flow, temp, pressure, level) Brief theory of each primary element Flow - orifice, Rota meters level -D.P. instrument, displayer type measurement, ultrasonic level measurement , Non contact type Ruder & Radioactive type Pressure - Bourdon tube type, capacitance type, strain gauge type. Temp - thermostats, thermocouple RTD, Field system, bimetallic.
3	Understanding final control element, control valves Selection of proper control valve. Sizing of control valves Automation of control valve operation Actuators and valve petitioners, IP Converters. Control loop - close loop and open loop system Solenoid /Remote operated ON-OFF valve Safety valve Pressure regulating valve.	Introduction to final control element, control valves Automation of control valve operation Actuators and valve positioners, IP Converters. Control loop - close loop and open loop system Solenoid /Remote operated ON-OFF valve Safety valve Pressure regulating valve.
4	Basic control theory and industrial applications of each type of controls Introduction to advance control devices Digital Microprocessor base control and monitoring devices – recorders and scanners	Basic control theory and applications Industrial applications of each type of controls Introduction to advance control devices Digital Microprocessor base control and monitoring devices– recorders and scanners.
5	ON -OFF Controller Single loop controller and multi loop controller Configuration and programming of above devices Tuning of controllers Understanding DCS and PLC PC interface of intelligent device	ON-OFF Controller Single loop controller and multi loop controller Configuration and programming of above devices Tuning of controllers Introduction to DCS and PLC PC interface of intelligent device
6-7	Process and industrial safety Hazards to various chemical process and nature of process, Legal provisions Safety devices - safety valves, safety relief valves (thermal& pressure) rapture Nitrogen blanketing system, self regulation,	Hazards to various chemical process and nature of process Legal provisions Safety devices - safety valves, safety relief valves (thermal & pressure) rapture disk Nitrogen blanketing system, self regulation,

	pressure control valve safety vacuum Fire alarm and smoke detection Hydrogen Safety interlock and /systematic shut down system	pressure control valve safety vacuum relief Fire alarm and smoke detection system Hydrogen gasses Safety interlock and trip /systematic shut down system
8-10	Overview of DCS, Architecture-block diagram, field control station, operator station, Features of operator satin, Networking with different control stations and operator station, Communication protocol conventional system, protocol conventional system profibus P.A. foundation field bus.	Overview of DCS, Architecture-block diagram, field control station, operator station, Features of operator satin, Networking with different control stations and operator station, Communication protocol conventional system, Profibus P.A. foundation field bus.
11-12	Handling of traffic control system Purpose of traffic control system Use of photo cells, different types of material used. Wiring diagram Benefits of traffic control system Practice about electrical logic Understanding of EPABX system Variable frequency device(in plant) (paint, packing industry, detergent industry)	Handling of traffic control system Purpose of traffic control system. Use of photo cells, different types of material used. Wiring diagram Benefits of traffic control system Study of electrical logic Introduction to EPABX system Variable frequency device(in plant) (paint, packing industry, detergent industry)
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.	**Unit**: 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 & Simplification**: Fractions, Decimal fraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems. Simplification using BODMAS.	**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.	**Square Root:** Square and Square Root, method of finding out square roots, Simple problem using calculator.	**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.	**Ratio &Proportion:** Simple calculation on related problems.	**Lettering and Numbering** as per BIS SP46-2003: - Single Stroke, Double Stroke, inclined, Upper case and Lower case.
5.	**Percentage:** Introduction, Simple calculation. Changing percentage to	**Free Hand sketch:** Hand tools and measuring instruments used in electronics

	decimal and fraction and vice-versa.	mechanics trades.
6.	**Material Science** : Properties -Physical & Mechanical, Types –Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.	**Free hand drawing :** - Lines, polygons, ellipse, etc. - Geometrical figures and blocks with dimension. - Transferring measurement from the given object to the free hand sketches.

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	**Symbolic Representation** (as per BIS SP:46-2003) of : - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Piping joints and fittings
2.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	Construction of Scales and diagonal scale P&I drawing symbols ISA 5.1 cable schedule
3.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Electrical and electronics element and components LED, IRLED, photo diode, photo transistor, opto- coupler symbols symbols of Logic gates
4.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboid, cylinder and Sphere. Surface area of solids – cube, cuboid, cylinder and Sphere.	Half adder, full adder, multiplexer and de-multiplexer
5.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding height and distance by trigonometry.	UJT, FET, MOSFET, DIAC, TRIC, SCR, IGBT symbols and circuits of FET Amplifier, SCR using UJT triggering, snubber circuit, light dimmer circuit using TRIAC, UJT based free running oscillator.

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	Basic of computer Networks (using real life examples), Definitions of

and Internet	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	Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue	

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, 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. Identify personal & plant safety procedures and use of safety equipment.
2. Prepare a Schematic Layout of the process and operation of the plant.
3. Find faults, troubleshoot, calibrate, connect common electrical measuring instruments, Continuity Testers, meggers, earth resistance testers and multi meters etc.
4. Test, connect with devices, start and control and reverse the direction of rotation of DC motors, AC single phase and three phase induction motors, synchronous motors.
5. Interpret electrical (Single line diagrams& MCC Panel wiring) & electronic circuits and its drawings. Test, operate & troubleshoot electronic based circuit.
6. Prepare, cable glanding, crimp, terminate and test various power/instrumentation cables used in industries.
7. Perform different soldering like metal to metal, wire to wire, wires to plugs, wires to connectors, wires to component PCB and de-soldering work.
8. Test basic electrical (MCBs, push buttons, relay, contactors)/electronic components (diodes, transistors, capacitors, coils, resistors etc.) using proper measuring instruments.
9. Configure, install, troubleshoot, upgrade and interconnect given computer system.
10. Test, operate and analyse the basic analog and digital electronic circuits.
11. Test and Operate microcontroller (8051) based systems.

Block – II

12. Identify location of the various sensing element, transmitter, controller, final control valve of a control loop.
13. Demonstrate and apply the mounting arrangements for field & control room instruments (Panel mounting, Wall mounting, Yoke mounting etc.).
14. Examine care, safety and proper use of hydraulic & pneumatic tubing & fittings, coupling and connectors.
15. Carry out Dismantling, Cleaning and Re-assembling of Air-Filters, Air Regulators. Connect pneumatic instruments & adjust as per name plate.
16. Remove and Re-Fit a plant instrument after properly isolating the section of plant. Follow Plant Procedure like SOP work order, clearance Certificates etc.
17. Calibrate and Maintain field instruments (displacement, pressure, flow, level, temperature etc.) and panel instruments (indicator, controller, convertor, recorder) used in instrumentation field.
18. Dismantle, inspect, calibrate and assemble various Control Valves, Valve Positioner, Convertor, various types of final elements and actuators.

19. Install and maintain various types of Control Loops like ON OFF, PID, feedback control loops etc and components (sensing clement, single indicator/recorder, controller and final control element), relays and annunciator.
20. Familiarize with instrument drawing in sketching, identify instruments symbols and blocks diagrams of existing units in the plant. Check Instrument and Panel Installation as per layout plan.
21. Install and maintain analytical instruments.
22. Install, test and maintain recorders, data loggers.
23. Test and calibrate digital protocol (HART) instruments. Prepare and test networking cables.
24. Operate PLC & HMI. Execute and correct programs in PLC. Check communication of PLC with HMI.
25. Operate DCS & SCADA system in the industry. Check PC interface of intelligent devices.

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

ADVANCE MECHANIC (INSTRUMENTS)			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-09 is required additionally)			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1.	Steel Rule (metric and English Marking)	150mm	20 nos.
2.	Watch maker screw driver	Set of six or above	20 nos.
3.	Plier flat Nose	100mm	20 nos.
4.	Hammer ball pain. With handle	250gms	20 nos.
5.	Twiserfine point	125mm	20 nos.
6.	File hand smooth	200mm	20 nos.
7.	File Flat 2nd cut	200mm	20 nos.
8.	Screw driver set	Set of5 pieces or above	20 nos.
9.	Adjustable spanner	15 mm	20 nos.
B: TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS			
10.	Neon(phase) tester	Voltage: 230volt	4nos.
11.	Eye glass3”focuswatchmaker	3”focus	4nos.
12.	Angle plate	-	2nos.
13.	Vee block with clamp pair		2nos.
14.	Hacksaw frame adjustable	200–300 mm	8 nos.
15.	Hammer ball pain	450gms.withhandle	2nos.
16.	Electric soldering iron(pencil tip)	6watt	4nos.
17.	Vice bench	jaw100mm	4nos.
18.	Pointer extractors(puller)		4nos.
19.	Punch center	100×10mm	2nos.
20.	Plier side cutting	150mm	2nos.
21.	Flaring toolset		1set
22.	Micrometer outside	0to25mm	1no.
23.	Micrometer outside	25to50mm	1no.
24.	Vernier height gauge	300 mm	2nos.
25.	Combination set	300mm	1no.
26.	Vernier caliper	150mm	2nos.
27.	Standard wire gauge	1 to 30 SWG or above can measurable	1no.
28.	Feeler gauge leaf type	26 blades, eng. & metric	1no.
29.	Radius gauge leaf type	1to15mm	1no.

30.	Dial test indicator in mm with accessories.	Standard size	1no.
31.	Micrometer inside	25mmwithextension upto150mm	1no.
32.	Combination plier heavy duty	150mm	6nos.
33.	Fire buckets		4nos.
34.	Tube cutter		1no.
35.	Tube bender		1no.
C: GENERAL MACHINERY INSTALLATIONS			
36.	Digital panel meters,	4digit	6 nos.
37.	Digital line frequency indicator		2nos.
38.	D.C. regulated power supply	0-15 or 30 V /2A or above With digital display	2 nos.
39.	Digital multi signal generator with frequencycounter	Generator- 1 MHz or above Square, sign, triangle generation Frequency counter- 10Hz or above Digital display	1no.
40.	Digital function generator	Generator- 10 MHz or above Digital display	1 no.
41.	Pulse generator	2 MHz or above	1 no.
42.	Digital insulation tester and megger	100 M ohm or above	1no. each
43.	Digital multimeter	Voltage (AC &DC) 0-700 V or above Current 0- 100 mA or above 0-10 A or above Resistance 0-1M or above Facility of continuity test, Diode test etc . Manual selection	2nos.
44.	Analog multimeter	Voltage (AC &DC) 0-700 V or above Current 0- 100 mA or above 0-10 A or above Resistance 0-1M or above Manual selection	2nos.
45.	Digital L.C.R. bridge/meter	Measures resistance, inductance, capacitance, quality factor etc	1no.
46.	Wire types train gauge (load cell/cantilevered) Instrument/Trainer		4nos. (2nos. each)
47.	Vibrometer sensing elements with application Trainer		2nos.
48.	Accelo merter		1no.

49.	Seismic instruments		2nos.
50.	Decade resistance , capacitive and inductance boxes	Resistance box-0 to 10 M ohms or above Capacitive and inductive box range as required	1no. each
51.	DC moving coil miliam meters (various ranges)	0-25 mA 0-100 mA 0-250 mA 0-750mA	2nos.
52.	Centre zero galvanometers	30-0-30 or above Size- 100 mm or above	2nos.
53.	AC moving iron type voltmeter (various ranges)	0-50V 0-150V 0-300V	3nos.
54.	AC moving iron type ammeter (various ranges)	0-1A 0-10A 0-50A	3nos.
55.	Watt meter dynamometer type	Single Phase 3000 watts /10 A or above AC type , 230V compatible	1no.
56.	Power factor meter	Single phase 10 A or above AC type , 230V compatible	1no.
57.	Watt hour meter induction type	Single phase 5 A or above	2nos.
58.	Ampere hour meter	Single phase 10 A or above	1no.
59.	Ohmmeter	0-10M ohms	2nos.
60.	Instrumentation amplifier trainer		1no.
61.	Trainers on network circuits		1no
62.	Discreet component trainer		1no.
63.	Trainers online arcircuits i.e. operational amplifiers		1no.
64.	Trainer on basic digital electronics i.e. logic gates Boolean Expression adder subtractor flip flop counter register converter etc.		1no.
65.	Trainers on power supplier's half wave rectifier full wave regulated power supply		2no.
66.	SCR driven/controlled power supply trainer		1no.
67.	Micro Controller Trainer		1 no

68.	Trainer on RS485 to RS232 converter.		1 no. each
69.	Pressure Comparator		1no.
70.	Pressure regulators with filter and input & output gauges	Range : 0-10 bar With input and output gauge	1no.
71.	Pressure transmitter for gauge and vacuum	Pressure transmitter : Input 0-7 bar or above Output 4-20 mA Vacuum transmitter Input: 0-30inch Hg Output 4-20 mA	1no.each
72.	Differential pressure transmitter(electronic-	Input : 0-1000 mm Wc or above Output : 4-20 mA	1no.
73.	Bourdon tube type, bellow type and Diaphragm type pressure gauges of various ranges	Dial size- 4 inch above Sensing element- SS or phosphor bronze Range- as required	2nos. each
74.	Pressure measurement trainer	Consisting one pressure process vessel minimum 20 liter capacity Bourden tube pressure gauge (C and spiral type one each) (0-7 kg/cm2) diaphram type pressure gauge (0-7 kg/cm2) electronic pressure transmitter (input 0- 7 Kg/cm2, output 4 to 20 mA) pnumatic pressure trasmitter (input 0-7 kg/cm2, output 3 to 15 psi) Pressure switch(0-7 kg/cm2) Absolute pressure gauge (7 kg/cm2) FRL unit with input and output gauge All the instruments are with safety hand valve, flanged arrangement for easy assembling and dismantling, with all necessary accessories and meters for operating and measurement. Tank consisting two extra tapping for connecting any other	1no.

		measurements.	
75.	Pressure controller	Controller : Input- 4 to 20 mA Output-4 to 20 mA Auto and manual tuning Digital display of process and set point Transmitter : Range: 0-5 bar or above Zero and span tunable Output- 4-20 mA Compatible supply Process tank : size as required Control valve : as required I/P converter : i/p 4-20 mA o/p -3-15mA	1 no.
76.	Pressure switches of various ranges	Range: 0-5 bar , 0-1 bar 0-20 bar or other suitable range	4nos. each
77.	Different types of manometers	U tube type - mercury filled, 600-0-600 mm or above Well type - 0-30 inch or above Inclined type 0-500 mm or above	1no. each
78.	P to I and I to P converters	I to P converter (input 4 to 20 mA, output 3 to 15 psi) P to I converter (input 0- 1 Kg/cm^2, output 4 to 20 mA) With pressure gauge0- 2 Kg/cm^2, current meter and current source 0 to 20 mA, FRL unit	1no. each.
79.	Vacuum tester with Low pressure measuring gauges such as thermal conductivity (pirani) gauge McL eodgauge, and vacuumpump.	**Vaccume tester** range 0-30 inch of Hg or above, **Vacumm pump**- 0-27 inch of Hg or above with gauge and valve. Thermal conductivity (pirani) gauge McLeod gauge specifications as required by system	1no. each.
80.	Vacuum gauge	100mmdial bourdon tube type	1no.
81.	Simple tank type quantity meter	100 Liter or above with sight glass scale (scale readout- in mm/liter) With drain valve	1no.

82.	Impeller type flow meter		1no.
83.	Deflecting and rotating vane type flow meter		1no. each.
84.	Helical and turbine flow meter		1no.
85.	Pitot tube flow meter		1no.
86.	Orifice type flow meter		1no.
87.	Ventury tube flow meter		1no.
88.	Rotameter		1no.
89.	Magnetic flow meter		1no.
90.	Vortex flow meter		1no.
91.	Flow measurement and control trainer	Consisting flow transmitter PID controller, I/P converter, FR unit, Control valve Pump and tank Controller : Input – 4-20 mA o/p 4-20 mA manual and auto tuning I/P - input 4-20 mA O/P 3-15 psi Pump ½ hp or above Flow transmitter – input : as required Output- 4-20 mA	1 no.
92.	Solid flow measurement and Control trainer		1 no.
93.	Flow DP transmitter		1 no.
94.	Integrated direct level indicator trainer (Hook type, sight glass type, float type level indicator)		1no.
95.	Static pressure and air purge type level indicator		1no.
96.	Electrical Type Level indicating transmitter with application trainer		1no.each
97.	Level controller		1no.
98.	Level measurement equipments for solid, sonic solid level, microwave, capacitance probes, diaphragm switches, nuclear gauge, sonic and microwave solid level detectors point level detector, conductivity type		1 no. each
99.	Stem and dial type bimetallic		2nos.

	thermometer(various ranges)		
100.	Liquid , Gas and Vapour pressure thermometer		2nos.each
101.	Temperature Trainer consisting of, RTD'S, thermister and different types Thermocouple.		1no.
102.	Temperature transmitter, pneumatic	Input range : as required Output : 3-15 PSI	1no.
103.	Temperature transmitter electronic (input RTD, TC)	RTD /Thermocouple transmitter : Sensor : as required Output : 4-20mA	1no. each
104.	Temperature Digital Indicator	Input sensor compatible : RTD or thermocouple Digital display	2 nos.
105.	Pyrometer with all accessories		1no.
106.	Trainer for measuring and controlling of temperature		1no.
107.	Temperature digital Controller	It consisting a controller, transmitter, Dry block oven or heating system. RTD /Thermocouple transmitter : Sensor : as required Output : 4-20mA Controller : Input – 4-20 mA o/p 4-20 mA manual and auto tuning .	1no.
108.	Digital temperature calibrator, mV/mA injector and measuring unit		1no. each
109.	Pneumatic and electronic recorders (single point and multipoint) Both circular and strip chart types		1no.each
110.	Paper less LCD/LED recorder setup		1no.
111.	Programmable logic controller (micro PLC) trainer kit		1no.
112.	Real PID controller trainer kit		1 no.
113.	Electric actuators		1no.
114.	Pneumatic and hydraulic actuators		1no.
115.	Different type of control valves such as gate valves, globe valves, Ball valves, diaphragm valves, butterfly valves etc. eclectically actuated, pneumatic actuated and hydraulic actuated		1no. each.

116.	Valve petitioners, booster relays, gland pickings etc.		1no. each.
117.	Cut section models of various type of control valve		1no.each.
118.	Air compressor		1 no.
119.	Hydraulic trainer		1no.
120.	Pneumatic trainer		1no.
121.	Conductivity meter AND Experimental set up for online conductivity measurement		1no. each
122.	pH meter Experimental set up for online pH measurement		1no. each
123.	Different type of Hygrometer		1no. each
124.	Hydrometer		1no.
125.	Experimental set up for online dissolved oxygen measurement		1 no.
126.	Computers (latest configuration) with tables (For operating various control system trainers) Licensed operating system, Latest Office (licensed version)		04 nos.
127.	LCD multimedia projector		01 no.
128.	Broad band internet connection		01 no.
129.	Printer(Scan/copy)		01 no.
130.	Networking tool kit		02 nos.
131.	Distributed control system(D.C.S.) Trainer kit		01 No.
132.	Data actuation system (SCADA)	(at least digital 8 input & 8 Output,4 analog input & output)	01 No.

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: Advance Mechanic (Instrument)

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°	(250 X 1.5 mm)	21
3.	Set square celluloid 30°-60°	(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**	**Maximum Marks (Total 100 Marks)**	**15**	**5**	**10**	**5**	**10**	**10**	**5**	**10**	**15**	**15**	**Total internal assessment Marks**	**Result (Y/N)**
				Safety consciousness	Workplace hygiene	Attendance/ Punctuality	Ability to follow Manuals/ Written instructions	Application of Knowledge	Skills to handle tools & equipment	Economical use of materials	Speed in doing work	Quality in workmanship	VIVA		
1															
2															