FITTER

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5

SECTOR – PRODUCTION & MANUFACTURING

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

FITTER

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
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1. TATA Motors/ TATA Steel
2. BAP/ BHEL, Ranipath
3. GRSE, Kolkata

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.

Fitter 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.

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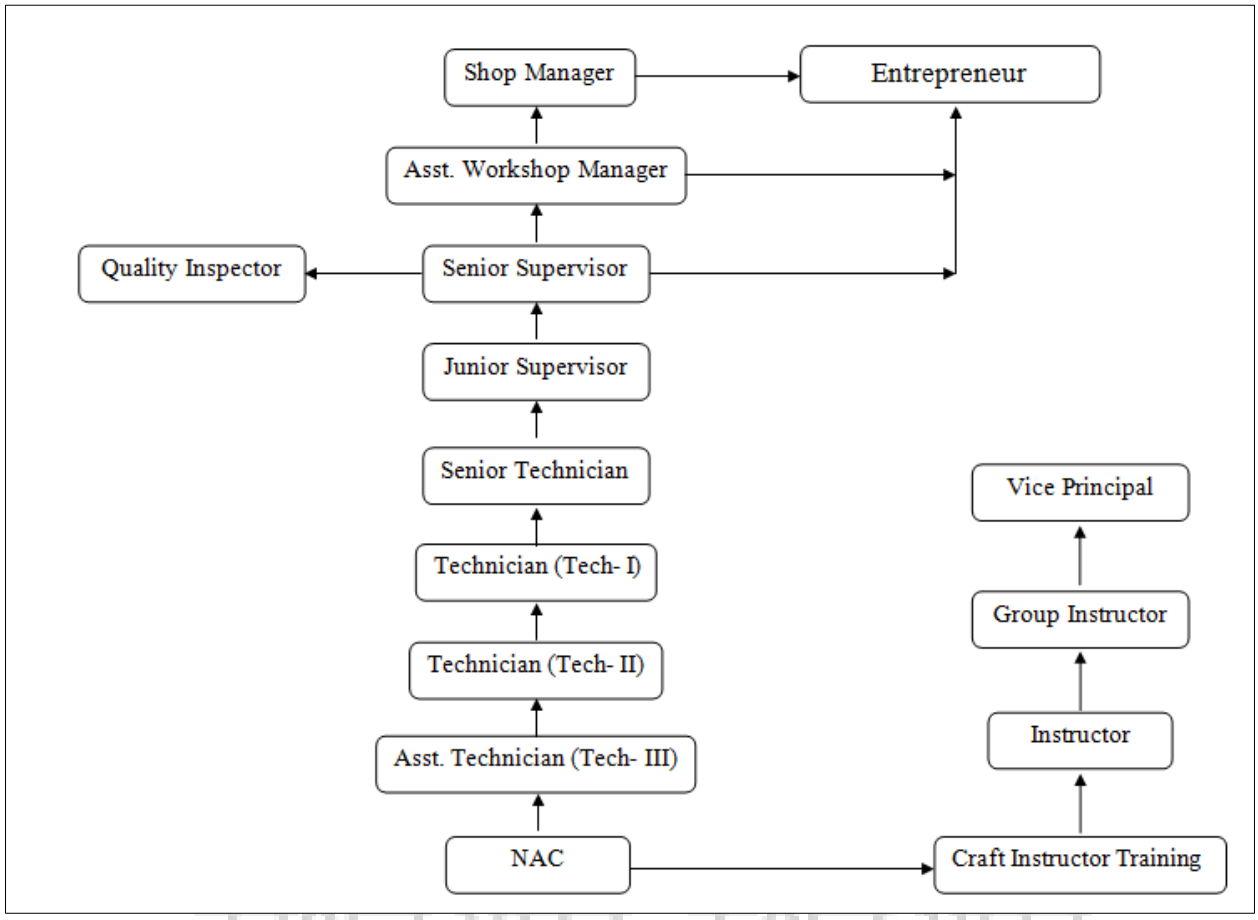
2.2 CAREER PROGRESSION PATHWAYS:

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- 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.)

SL. 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:

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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:

Fitter General sizes metal parts to close tolerances and fits and assembles them using hand tools for production or repairs of machines, or other metal products. Studies drawings to understand specification of different parts, fittings or assembles to be made and their functions. They select materials, appropriate tool and equipments to carry out their work. Holds the work in Vice, Cuts and shapes required parts to dimensions and specifications by processes of sawing, chipping, filing, grinding, drilling holes, screw cutting, scrapping etc., using hand tools for making specimens or finished components. Measures object while working using foot rules, calipers, micrometer, gauges etc. and checks for correct filing with square. Gets half-finished object marked or marks it himself using face plate, marking block scriber, vernier, height gauges, vee-blocks, angle plate, sine plate, slip gauges, combination set, etc. depending on accuracies required, to indicate guide lines for finished sizes, holes to be drilled and pitch centres, threads to be cut and other working details as specified in drawing or sample. Clamps object securely in correct position in vice and files it to required dimensions according to punch marks and guide lines frequently measuring it with calipers, micrometer, vernier, gauges etc, makes holes with drill, cuts threads with taps and dies ensuring that they are square or at required angle to base. Measures finished article with dial indicator, micrometer, vernier, height gauges, screw gauges, plug gauges, sine bar, slip gauge, etc according to prescribed accuracies. May make parts separately and assemble those with screws, rivets, pins, etc. as specified so as to make complete unit according to drawing. Dismantles or removes worn out, broken or defective parts using hand tools or power tools and replaces them by repaired or new ones. Performs repairing and maintenance work (including preventive maintenance) of simple machines, dismantles and replaces different components to construct circuit of Pneumatics and Hydraulics. Tests completed article/ assembly to ensure correct performance. May do simple turning of parts on machines and perform welding, brazing, and like operations. May explain heat treatment processes viz., annealing, hardening, tempering etc. May specialize in particular type of machine or product and be designated accordingly. May suggest alterations.

In addition Fitter have the ability to visualize the job, good coordination, mechanical attitude, manual dexterity and perform work related mathematical calculations.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

May be designated as FITTER General according to nature of work done.

Reference NCO:

i) NCO-2015: 7233.0100
ii) NCO-2015: 7233.0200

4. NSQF LEVEL COMPLIANCE

NSQF level for Fitter 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 Fitter 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	FITTER
NCO - 2015	7233.0100 7233.0200
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 with Science and Mathematics 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 of Basic Training	As per related trades 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	01 year
CTS trades eligible for Fitter Apprenticeship	1. Fitter 2. MMTM 3. Tool & Die Maker

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 Fitter 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 -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, 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, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*

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. Practice and understand precautions to be followed while working in fitting jobs.
2. Prepare different types of documentation as per industrial need by different methods of recording information.

3. File and fit matting parts with in an accuracy of ±.02 mm and to ISI specification.
4. Scrape angular matting and sliding surfaces and original flat surfaces without master.
5. Prepare keys and key ways a shaft and assemble.
6. Drill through holes and blind holes at an angle.
7. Hand and machine reaming on finish drilled holes
8. Ream tapers and fit pins.
9. Bend steel pipes to different radius and angles.
10. Thread standard pipes, join pipes and make pipe assemble.
11. Dismantle, and minor repair and assemble simple machine tools such as drill machine, shaper, lathe and power saw.
12. Erect and align machines.
13. Assemble finished mechanical component to from specific unit or machine such as grinder pump etc. Using hand tools and machines.
14. Dismantle or remove worn out broken or defective parts using hand tools and replace them by repaired or new one's test completed article to ensure correct performance.
15. Fit parts together in set order using nuts, bolts, screws and pins etc. with necessary wrenches, spanners and other special tools.

Block – II

16. Assemble components accurately using dowel pins & screws.
17. Assemble parts by riveting, screwing, pinning, welding as to make complete unit according to drawing.
18. Mounting of Pulleys and Gears on shafts.
19. Mechanical handling of machines for transportation purposes involve the use of screw jacks, pulley blocks, cranes, hoists and slings, roller bars and wire ropes etc.
20. Remove and fit ball and roller bearings.
21. Repair broken gear teeth by pigging and dovetailing.
22. Size metal parts to close tolerances and fits and assemble them using hand tools for production or repairs of mechanical device or other metal products.
23. Lap and finish flat Surfaces.
24. Heat treat plain carbon steel.
25. Anneal and bend copper pipes to different shapes
26. Handle Jigs and Fixtures

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27. Make simple Limit Gauges and Templates
28. Solder and joint ferrous and non ferrous component (soft and hard).
29. Familiarization with pumps, air compressor, pneumatic tools and hydraulic driver machines.
30. Accuracy testing of Machine tools such as geometrical parameters.
31. Dismantling and mounting of pulleys.
32. Use simple jigs and fixtures for drilling.
33. Dismounting, repairing damaged gears and mounting and check for workability.
34. Repair & replacement of belts and check for workability.
35. Maintenance, troubleshooting, and safety aspects of pneumatic and hydraulic systems

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 mathematical calculation & science in the field of study including basic	2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction.

electrical and apply in day to day work. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*	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 dimensional accuracy of assembly 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-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*	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 such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (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	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.

productivity & quality.	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	
*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.*	

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	1. Importance of trade training, List of tools & Machinery used in the trade. 2. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE). 3. First Aid Method and basic training 4. Safety signs for Danger, Warning, caution & personal safety message 5. Preventive measures for electrical accidents & steps to be taken in such accidents. 6. Use of Fire extinguishers 7. Identification of tools &equipments as per desired specifications for marking & sawing.	All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute system including stores procedures. Job area after completion of training. Importance of safety and general precautions observed in the in the industry/shop floor. Introduction of First aid. Operation of electrical mains and electrical safety. Introduction of PPEs. Response to emergencies e.g.; power failure, fire, and system failure. **Importance of housekeeping & good shop floor practices.** Introduction to 5S concept & its application. **Occupational Safety & Health**: Health, Safety and Environment guidelines, legislations & regulations as applicable. Bench vice types, uses, care & maintenance, vice clamps. Measuring standards (English, Metric Units), Linear & angular measurements- their units. Try square, ordinary depth gauge, protractor- description, uses and cares.
2.	8. Filing Channel, Parallel. 9. Filing practice, surface filing, marking of straight and parallel lines with odd leg calipers and steel rule. 10. Marking off straight lines and ARCs using scribing block and dividers.	Files- specifications, description, materials, grades, cuts, file elements, uses. Types of files, care and maintenance of files. Marking off and layout tools, dividers, scribing block, punches- description, classification, material, care & maintenance.

	11. Chipping flat surfaces along a marked line. 12. Marking, filing, filing square and check using tri-square.	Calipers- types, uses & care. Surface plate and auxiliary marking equipment, 'V' block, angle plates, parallel block, description, types, uses. Different types of hammers & uses. Physical properties of engineering metal: colour, weight, structure, and conductivity, magnetic, fusibility, specific gravity. Mechanical properties: ductility, malleability hardness, brittleness, toughness, tenacity, and elasticity.
3.	13. Marking according to simple blue prints for locating, position of holes, scribing lines on chalked surfaces with marking tools. (20 hrs.) 14. Finding center of round bar with the help of 'V' block and marking block. (5 hrs.) 15. Filing flat, square, and parallel to an accuracy of 0.5mm. (10 hrs.) 16. Chipping, Chamfering, Chip slots & oils grooves (Straight). 17. Saw along a straight line, curved line, on different sections of metal.	Micrometer- outside and inside – principle, constructional features, parts graduation, leading, use and care. Micrometer depth gauge, parts, graduation, leading, use and care. Digital micrometer. Vernier calipers, principle, construction, graduations, reading, use and care. Vernier bevel protractor, construction, graduations, reading, use and care, dial Vernier Caliper, Digital verniercaliper.
4.	18. Marking of straight lines, circles, profiles and various geometrical shapes and cutting the sheets with snips. 19. Marking out for flaps for soldering and sweating. 20. Make various joints: wiring, hemming, soldering and brazing, form locked, grooved and knocked up single hem straight and curved edges form double hemming,. 21. Practice in soft soldering and silver soldering.	Safety precautions to be observed in a sheet metal workshop, sheet and sizes, Commercial sizes and various types of metal sheets, coated sheets and their uses as per BIS specifications. Marking and measuring tools, wing compass, Prick punch, tin man's square tools, snips, types and uses. Tin man's hammers and mallets type-sheet metal tools. Various types of metal joints, their selection and application, tolerance for various joints, their selection & application. Wired edges. Solder and soldering: Introduction-types of solder and flux. Composition of various types of solders and their heating media of soldering iron. Method of soldering, selection and application-joints.

		Hard solder- Introduction, types and method of brazing.
5-6.	22. Welding - Striking and maintaining ARC, laying Straight-line bead. 23. Making square, butt joint and 'T' fillet joint-gas and ARC. 24. Do setting up of flames, fusion runs with and without filler rod, and gas. 25. Make butt weld and corner, fillet in ARC welding(25 hrs.) 26. Gas cutting of MS plates(25 hrs.) 27. File steps and finish with smooth file to accuracy of ± 0.25 mm.	Drilling processes: common type (bench type, pillar type, radial type), gang and multiple drilling machine. Various rivets shape and form of heads, importance of correct head size. Riveting tools, dolly snaps description and uses. Method of riveting, The spacing of rivets, comparison of hot and cold riveting. Importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before, during, after) Machines and accessories, welding transformer, welding generators. Welding hand tools: Hammers, welding description, types and uses, description, principle, method of operating, carbon dioxide welding. H.P. welding equipment: description, principle, method of operating L.P. welding equipment: description, principle, method of operating. Types of Joints-Butt and fillet as per BIS SP: 46-1988 specifications. Gases and gas cylinder description, kinds, main difference and uses. Setting up parameters for ARC welding machines-selection of Welding electrodes. Care to be taken in keeping electrode. Oxygen acetylene cutting-machine description, parts, uses, method of handling, cutting torch-description, parts, function and uses.
7.	28. Mark off and drill through holes. 29. Drill on M.S. flat. 30. Make riveted lap and butt joint. 31. Riveting with as many types of rivet as available, use of counter sunk head rivets.	Screw threads: terminology, parts, types and their uses. Determination of tap drill size. Screw pitch gauge: material parts and uses. Taps British standard (B.S.W., B.S.F., B.A. & B.S.P.) and metric /BIS (course and fine) material, parts (shank body, flute, cutting edge).

	32. Practice use of angular measuring instrument.	Tap wrench: material, parts, types (solid &adjustable types) and their uses removal of broken tap, studs (tap stud extractor). Dies: British standard, metric and BIS standard, material, parts, types, Method of using dies. Die stock: material, parts and uses.
8.	33. Counter sink, counter bore and ream split fit (three piece fitting). 34. Form internal threads with taps to standard size (through holes and blind holes). 35. Prepare studs and bolt. 36. Form external threads with dies to standard size. 37. Prepare nuts and match with bolts.	Drill- material, types, (Taper shank, straight shank) parts and sizes. Drill angle-cutting angle for different materials, cutting speed feed. R.P.M. for different materials. Drill holding devices- material, construction and their uses. Counter sink, counter bore and spot facing-tools and nomenclature, Reamer- material, types (Hand and machine reamer), kinds, parts and their uses, determining hole size (or reaming), Reaming procedure. Drill troubles: causes and remedy. Equality of lips, correct clearance, dead centre, length of lips. Grinding wheel: Abrasive, grade structures, bond, specification, use, mounting and dressing. Selection of grinding wheels. Bench grinder parts and use. Radius/fillet gauge, feeler gauge, hole gauge, and their uses, care and maintenance.
9.	38. Make sliding 'T' fit. 39. Make sliding fit with angles other than 90^{o}	Interchangeability: Necessity in Engg, field definition, BIS. Definition, types of limit, terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone Different standard systems of fits and limits. British standard system, BIS system Method of expressing tolerance as per BIS Fits: Definition, types, description of each with sketch. Vernier height gauge: material construction, parts, graduations (English & Metric) uses, care and maintenance.
10.	40. File and make Step fit, angular fit, angle, surfaces (Bevel gauge accuracy 1 degree).(15 hrs.) 41. Make simple open and sliding	Pig Iron: types of pig Iron, properties and uses. Cast Iron: types, properties and uses. Wrought iron- : properties and uses.

	fits.(10 hrs.) 42. Scrap on flat surfaces, curved surfaces and parallel surfaces and test. 43. Check for blue math of bearing surfaces- both flat and curved surfaces by wit worth method.	Steel: plain carbon steels, types, properties and uses. Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses. Simple scraper- circular, flat, half round, triangular and hook scraper and their uses. Blue matching of scraped surfaces (flat and curved bearing surfaces) Vernier micrometer, material, parts, graduation, use, care and maintenance. Calibration of measuring instruments. Introduction to mechanical fasteners and its uses. Dial test indicator, construction, parts, material, graduation, Method of use, care and maintenance. Digital dial indicator. Comparators-measurement of quality in the cylinder bores.
11-12.	44. True job on four jaw chuck using knife tool. 45. Face both the ends for holding between centers. 46. Using roughing tool parallel turn ± 0.1 mm. 47. Holding job in three jaw chuck. 48. Perform the facing, plain turn, step turn, parting, deburr, chamfer-corner, round the ends, and use form tools. 49. Cut grooves- square, round, 'V' groove. 50. Knurl the job. 51. Bore holes –spot face, pilot drill, enlarge hole using boring tools. 52. Turn taper (internal and external). 53. Make external 'V' thread.	Safely precautions to be observed while working on a lathe, Lathe specifications. Lathe main parts descriptions- bed, head stock, carriage, tail stock, feeding and thread cutting mechanisms. Holding of job between centers and their applications. Lathe cutting tools- Nomenclature of single point & multipoint cutting tools, Tool selection based on different requirements and necessity of correct grinding, solid and tipped, throw away type tools, cutting speed and feed and comparison for H.S.S., carbide tools. Use of coolants and lubricants. Chucks and chucking the independent four-jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck-mounting and dismounting, chucks, chucking true, face plate, drilling - method of holding drills in the tail stock, Boring tools and enlargement of holes. General turning operations- parallel or straight, turning. Stepped turning, grooving, and shape of tools for the above operations.

		Knurling: - tools description, grade, uses, speed and feed, coolant for knurling, speed, feed calculation. Taper – definition, use and method of expressing tapers. Standard tapers-taper, calculations morse taper. Screw thread definition – uses and application. Square, worm, buttress, acme (non standard-screw threads), Principle of cutting screw thread in centre lathe – principle of chasing the screw thread – use of centre gauge, setting tool for cutting internal and external threads, use of screw pitch gauge for checking the screw thread.
13.	54. Perform the routine maintenance with check list. 55. Monitor machine as per routine checklist 56. Read pressure gauge, temperature gauge, oil level. 57. Set pressure in pneumatic system.	**Maintenance** -Total productive maintenance -Autonomous maintenance -Routine maintenance -Maintenance schedule -Retrieval of data from machine manuals Preventive maintenance-objective and function of Preventive maintenance, section inspection. Visual and detailed, lubrication survey, system of symbol and colour coding. Revision, simple estimation of materials, use of handbooks and reference table. Possible causes for assembly failures and remedies. Assembling techniques such as aligning, bending, fixing, mechanical jointing, threaded jointing, sealing, and torquing. Dowel pins: material, construction, types, accuracy and uses.
	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	58. File & fit angular mating surface within an accuracy of ± 0.02 mm & 10 minutes angular fitting.	Screws: material, designation, specifications, Property classes (e.g. 9.8 on screw head), Tools for tightening/ loosening of screw or bolts, Torque wrench, screw joint calculation uses. Power tools: its uses & maintenance. Locking device: Nuts- types (lock nut castle nut, slotted nuts, swam nut, grooved nut) description and use. Various types of keys, allowable clearances & tapers, types, uses of key pullers.
2.	59. Drilling and reaming, small dia. holes to accuracy & correct location for fitting. 60. Perform drilling using 'V' block and a clamp. 61. Make male and female fitting parts, drill and ream holes not less than 12.7 mm.	Templates and gauges- Introduction, necessity, types. Limit gauge: Ring gauge, snap gauge, plug gauge, description and uses. Description and uses of gauge- types (feeler, screw, pitch, radius, wire gauge) Slip gauge: Necessity of using, classification & accuracy, set of blocks (English and Metric). Details of slip gauge. Metric sets 46: 103: 112. Wringing and building up of slip gauge and care and maintenance. Application of slip gauges for measuring, Sine bar- Principle, application & specification. Procedure to check adherence to specification and quality standards.
3.	62. Lap flat surfaces using lapping plate. Lapping holes and cylindrical surfaces. 63. Scrapping cylindrical bore and to make a fit.	Lapping: Application of lapping, material for lapping tools, lapping abrasives, charging of lapping tool. Surface finish importance, equipment for testing-terms relation to surface finish. Equipment for tasting surfaces quality – dimensional tolerances of surface finish. Honing: Application of honing, material for honing, tools shapes, grades, honing abrasives. Frosting- its aim and the methods of performance.
4.	64. Prepare Stepped keyed fitting and test job.	Tapers on keys and cotters permissible by various standards. Gauges and types of gauge commonly used in

		gauging finished product-Method of selective assembly 'Go' system of gauges, hole plug basis of standardization. Metallurgical and metal working processes such as Heat treatment, various heat treatment methods -normalizing, annealing, hardening and tempering, purpose of each method, tempering colour chart. Annealing and normalizing, Case hardening and carburising and its methods, process of carburising (solid, liquid and gas).
5	65. Identify different ferrous metals by spark test. 66. File and fit straight and angular surfaces internally.	Bearing-Introduction, classification (Journal and Thrust), Description of each, ball bearing: Single row, double row, description of each, and advantages of double row. Roller and needle bearings: Types of roller bearing. Description & use of each. Method of fitting ball and roller bearings Bearing metals – types, composition and uses. Synthetic materials for bearing: The plastic laminate materials, their properties and uses in bearings such as phenolic, teflon polyamide (nylon).
6-7	67. Flaring of pipes and pipe joints. 68. Cutting & Threading of pipe length 69. Fitting of pipes as per sketch observing conditions used for pipe work. 70. Bending of pipes- cold and hot. 71. Dismantling & assembling –	Pipes and pipe fitting- commonly used pipes. Pipe schedule and standard sizes. Pipe bending methods. Use of bending fixture, pipe threads- Std. Pipe threads Die and Tap, pipe vices. Use of tools such as pipe cutters, pipe wrenches, pipe dies , and tap, pipe bending machine etc. Standard pipefitting- Methods of fitting or replacing the above fitting, repairs and erection

	globe valves, sluice valves, stop cocks, seat valves and non-return valve. 72. Fit & assemble pipes, valves and test for leakage & functionality of valves. 73. Visual inspection for visual defects e.g. dents, surface finish. 74. Measuring, checking and recording in control chart.	on rainwater drainage pipes and house hold taps and pipe work. Jigs & Fixtures- their applications and difference. Drilling jig-constructional features, types and uses. Fixtures-Constructional features, types and uses. Different types of jig bush, care & maintenance if jigs and fixtures.
8.	75. Drilling and reaming holes in correct location, fitting dowel pins, stud, and bolts.	Aluminium and its alloys. Uses, advantages and disadvantages, weight and strength as compared with steel. Non-ferrous metals such as brass, phosphor bronze, gunmetal, copper, aluminium etc. Their composition and purposes, where and why used, advantages for specific purposes, surface wearing properties of bronze and brass. Inspection & Quality control -Basic SPC -Visual Inspection
9.	76. Making & replacing damaged keys. 77. Repair of broken gear tooth by stud and repair broker gear teeth by dovetail.	Power transmission elements. The object of belts, their sizes and specifications, materials of which the belts are made, selection of the type of belts with the consideration of weather, load and tension methods of joining leather belts. Vee belts and their advantages and disadvantages, Use of commercial belts, dressing and resin creep and slipping, calculation. Power transmissions- coupling types-flange coupling,-Hooks coupling-universal coupling and their different uses. Pulleys-types-solid, split and 'V' belt pulleys, standard calculation for determining size crowning of faces-loose and fast pulleys-jockey pulley. Types of drives-open and cross belt drive. Power transmission –by gears, most common form spur gear, set names of some essential parts of the set-The pitch circles, Diametral pitch, velocity ratio of a gear set. Helical gear, herring bone gears, bevel gearing, spiral bevel gearing, hypoid gearing, pinion and

		rack, worm gearing, velocity ratio of worm gearing. Repair of gear teeth by building up and dovetail method.
10-12.	78. Identify pneumatic components – Compressor, pressure gauge, Filter-Regulator-Lubricator (FRL) unit, and Different types of valves and actuators. 79. Dismantle, replace, and assemble FRL unit 80. Identify the parts of a pneumatic cylinder 81. Construct a control circuit for the control of a d/a pneumatic cylinder with momentary input signals 82. Construct a circuit for the direct & indirect control of a d/a pneumatic cylinder with a single & double solenoid valve 83. Demonstrate knowledge of safety procedures in hydraulic systems (Demo by video) 84. Identify hydraulic components – Pumps, Reservoir, Fluids, Pressure relief valve (PRV), Filters, different types of valves, actuators, and hoses 85. Identify internal parts of hydraulic cylinders, pumps/motors. 86. Construct a circuit for the control of a s/a hydraulic cylinder using a 3/2-way valve (Weight loaded d/a cylinder may be used as a s/a cylinder), 4/2 & 4/3 way valves.	Fluid power, Pneumatics, Hydraulics, and their comparison, Overview of a pneumatic system. Compressed air generation and conditioning, Air compressors, Pressure regulation, Dryers, Air receiver, Conductors and fittings, FRL unit, Applications of pneumatics, Hazards & safety precautions in pneumatic systems. Pneumatic actuators:- Types, Basic operation, Force, Stroke length, Single-acting and double-acting cylinders. Pneumatic valves:- Classification, Symbols of pneumatic components, 3/2-way valves (NO & NC types) (manually-actuated & pneumatically-actuated) & 5/2-way valves, Check valves, Flow control valves, One-way flow control valve Pneumatic valves: Roller valve, Shuttle valve, Two-pressure valve - Electro-pneumatics: Introduction, 3/2-way single solenoid valve, 5/2-way single solenoid valve, 5/2-way double solenoid valve, Control components -Pushbuttons (NO & NC type) and Electromagnetic relay unit, Logic controls - Symbols of hydraulic components, Hydraulic oils –function, properties, and types, Contamination in oils and its control - Hydraulic Filters – types, constructional features, and their typical installation locations, cavitation, Hazards & safety precautions in hydraulic systems - Hydraulic reservoir & accessories, Pumps, Classification – Gear/vane/ piston types, Pressure relief valves – Direct acting and pilot-operated types - Pipes, tubing, Hoses and fittings – Constructional details, Minimum bend radius, routing tips for hoses - Hydraulic cylinders –Types - Hydraulic motors –Types - Hydraulic valves: Classification, Directional

		Control valves – 2/2- and 3/2-way valves - Hydraulic valves: 4/2- and 4/3-way valves, Centre positions of 4/3-way valves - Hydraulic valves: Check valves and Pilot-operated check valves, Load holding function - Flow control valves: Types, Speed control methods – meter-in and meter-out - Preventive maintenance & troubleshooting of pneumatic & hydraulic systems, System malfunctions due to contamination, leakage, friction, improper mountings, cavitation, and proper sampling of hydraulic oils
13.	87. Simple repair of machinery: - Making of packing gaskets. 88. Perform routine check of machine and do replenish as per requirement. 89. Practicing, making various knots, correct loading of slings, correct and safe removal of parts. 90. Inspection of machine tools & accuracy testing of machine tools.	Clutch: Type, positive clutch (straight tooth type, angular tooth type) . Washers-Types and calculation of washer sizes. The making of joints and fitting packing. Chains, wire ropes and clutches for power transmission. Their types and brief description. Lubrication and lubricants- purpose of using different types, description and uses of each type. Method of lubrication. A good lubricant, viscosity of the lubricant, Main property of lubricant. Foundation bolt: types (rag, Lewis cotter bolt) description of each erection tools, pulley block, crow bar, spirit level, Plumb bob, wire rope, manila rope, wooden block. The use of lifting appliances, extractor presses and their use. Practical method of obtaining mechanical advantage. The slings and handling of heavy machinery, special precautions in the removal and replacement of heavy parts.
	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.*

9.1 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
2.	**Fractions**: Fractions, Decimal fraction, Addition, Subtraction, Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Calculator.	**Drawing Instruments : their 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.
3.	**Properties of Material** : 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 Alloys.	**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
4.	**Average :** Problems of Average. **Ratio &Proportion** : Simple calculation on related problems.	**Drawing of Geometrical Figures:** Drawing practice on: - Angle: Measurement and its types, method of bisecting. - Triangle -different types - Rectangle, Square, Rhombus, Parallelogram. - Circle and its elements.

5.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density.	**Dimensioning:** - Definition, types and methods of dimensioning (functional, non-functional and auxiliary) - Types of arrowhead - Leader Line with text
6.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.	**Free hand drawing of** - Lines, polygons, ellipse, etc. - geometrical figures and blocks with dimension - Transferring measurement from the given object to the free hand sketches.
7.	- Forces definition. - Definition and example of compressive, tensile, shear forces, axial and tangential forces. Stress, strain, ultimate strength, factor of safety for MS. **Speed and Velocity**: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.	**Method of presentation of Engineering Drawing** - Pictorial View - Orthogonal View - Isometric view
8.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle. Volume of solids – cube, cuboids, cylinder and Sphere. Surface area of solids – cube, cuboids, cylinder and Sphere. - Area of cut-out regular surfaces: circle and segment and sector of circle. - Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple solid blocks.	**Symbolic Representation (as per BIS SP:46-2003) of :** - Fastener (Rivets, Bolts and Nuts) - Bars and profile sections - Weld, brazed and soldered joints. - Electrical and electronics element - Piping joints and fittings
9.	**Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). - Circular Motion: Relation between	**Dimensioning practice:** - Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003) - Symbols preceding the value of dimension and dimensional tolerance.

	circular motion and Linear motion, Centrifugal force, Centripetal force.	
10.	**Work, Power and Energy**: work, unit of work, power, unit of power, Horse power, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.	**Construction of Geometrical Drawing Figures:** - Polygons and their values of included angles. Conic Sections (Ellipse)
11.		**Projections:** - Concept of axes plane and quadrant. - Orthographic projections - Method of first angle and third angle projections (definition and difference) - Symbol of 1st angle and 3rd angle projection as per IS specification. Drawing of Orthographic projection from isometric/3D view of blocks

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration : - 30 hrs.)**
1.	**Trigonometry:** Trigonometric ratios, Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry.	Machined components; concept of fillet & chamfer; surface finish symbols.
2.	**Friction** and its application in Workshop practice.	Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
3.	**Heat & Temperature**: Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.	- Reading & interpretation of assembly drawing and detailing.
4.	**Basic Electricity**: Introduction, use of electricity, Types of current_ AC, DC, their comparison, voltage, resistance, their units. Conductor, insulator, Types of connections – series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthing.	Reading of drawing. Simple exercises related to missing lines, dimensions and views. How to make queries.
5.	**Heat treatment** – Necessity, different common types of Heat treatment.	Simple exercises related to trade related symbols. Solution of NCVT test papers.
6.	**Graph:** Read images, graphs, diagrams bar chart, pie chart. Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.	
7.	**Transmission of power:** By belt, pulleys & gear drive.	
8.	**Concept of pressure** – units of pressure, atmospheric pressure, gauge pressure – gauges used for measuring pressure. **Introduction to pneumatics & hydraulics systems.** Solution of NCVT test papers	

9.2 EMPLOYABILITY SKILLS

(DURATION: - 110 HRS.)

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

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

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

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

10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR TURNER TRADE:

9. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
10. Record keeping and documentation
11. Making components observing different metal removing procedure and perform different fitting job.
12. Assembling of different components as per requirement and check functionality.
13. Carryout maintenance of different machines including hydraulics & pneumatics system.

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

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

Block – I

1. Practice and understand precautions to be followed while working in fitting jobs.
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. File and fit matting parts with in an accuracy of ±.02 mm and to ISI specification.
4. Scrape angular matting and sliding surfaces and original flat surfaces without master.
5. Prepare keys and key ways a shaft and assemble.
6. Drill through holes and blind holes at an angle.
7. Hand and machine reaming on finish drilled holes
8. Ream tapers and fit pins.
9. Bend steel pipes to different radius and angles.
10. Thread standard pipes, join pipes and make pipe assemble.
11. Dismantle, and minor repair and assemble simple machine tools such as drill machine, shaper, lathe and power saw.
12. Erect and align machines.
13. Assemble finished mechanical component to from specific unit or machine such as grinder pump etc. Using hand tools and machines.
14. Dismantle or remove worn out broken or defective parts using hand tools and replace them by repaired or new one's test completed article to ensure correct performance.
15. Fit parts together in set order using nuts, bolts, screws and pins etc. with necessary wrenches, spanners and other special tools.

Block – II

Fitter

16. Assemble components accurately using dowel pins & screws.
17. Assemble parts by riveting, screwing, pinning, welding as to make complete unit according to drawing.
18. Mounting of Pulleys and Gears on shafts.
19. Mechanical handling of machines for transportation purposes involve the use of screw jacks, pulley blocks, cranes, hoists and slings, roller bars and wire ropes etc.
20. Remove and fit ball and roller bearings.
21. Repair broken gear teeth by pigging and dovetailing.
22. Size metal parts to close tolerances and fits and assemble them using hand tools for production or repairs of mechanical device or other metal products.
23. Lap and finish flat Surfaces.
24. Heat treat plain carbon steel.
25. Anneal and bend copper pipes to different shapes
26. Handle Jigs and Fixtures
27. Make simple Limit Gauges and Templates
28. Solder and joint ferrous and non ferrous component (soft and hard).
29. Familiarization with pumps, air compressor, pneumatic tools and hydraulic driver machines.
30. Accuracy testing of Machine tools such as geometrical parameters.
31. Dismantling and mounting of pulleys.
32. Use simple jigs and fixtures for drilling.
33. Dismounting, repairing damaged gears and mounting and check for workability.
34. Repair & replacement of belts and check for workability.
35. Maintenance, troubleshooting, and safety aspects of pneumatic and hydraulic systems

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

FITTER			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)			
A. TRAINEES TOOL KIT (For each additional unit trainees tool kit Sl. 1-18 is required additionally)			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1	Steel Rule	15 cm with metric graduation	21 nos.
2	Try Square.	150 mm blade	21 nos.
3	Caliper inside spring type.	150 mm	21 nos.
4	Caliper hermaphrodite spring type	150 mm	21 nos.
5	Caliper outside spring type	150 mm	21 nos.
6	Divider spring type	150 mm	21 nos.
7	Scriber	150 mm	21 nos.
8	Centre Punch	10 mm and Length - 120 mm	21 nos.
9	Screw driver	150mm insulated flat type	21 nos.
10	Chisel cold flat	20 mm X 150 mm High carboon steel	21 nos.
11	Hammer ball peen With handle	450 grams (1 lb)	21 nos.
12	Hammer ball peen With handle.	220 grams (1/2 lb)	21 nos.
13	File flat - second cut	250 mm	21 nos.
14	File flat smooth	250 mm.	21 nos.
15	File half round second cut	150 mm.	21 nos.
16	Hacksaw frame fixed type	300 mm	21 nos.
17	Safety goggles.		21 nos.
18	Dot punch	100 mm	21 nos.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			
19.	Steel Rule	30 cm	4 nos.

20.	Steel Rule	60 cm.	4 nos.
21.	Straight edge steel	45 cm	2 nos.
22.	Surface plate CI / Granite.	45 x 45 cm	1 nos.
23.	Marking table	91 x 91 x 122 cm.	1 no.
24.	Universal scribing block	22 cm.	2 nos.
25.	V-Block pair with clamps	7 cm and 15 cm	2 nos.
26.	Square adjustable blade.	15 cm	2 nos.
27.	Angle plate.	10 x 20 cm	1 nos.
28.	Spirit Level metal	15 cm	1 no.
29.	Punch letter set.	3 mm	1 no.
30.	Punch number set.	3 mm	1 no.
31.	Punch hollow	6 mm to 19 set of 5	2 nos.
32.	Punch round	3mm x 4 mm set of 2	2 nos.
33.	Portable hand drill (Electric)	0 to 6 mm	1 nos.
34.	Drill twist straight shank	1.5 to 12 mm by 0.5 mm	1 Set
35.	Drill twist straight shank	8 mm to 15 mm by ½ mm	1 Set
36.	Taps and dies complete set in box B.A		1 no.
37.	Taps and dies complete set in box with-worth.		1 no.
38.	Taps and dies complete set in box	3-18 mm set of 10	1 no.
39.	File warding smooth	15 cm	4 nos.
40.	File knife edge smooth	15 cm	4 nos.
41.	File cut saw smooth	15 cm	2 nos.
42.	File Rounded edge smooth	15 cm	2 nos.
43.	File triangular smooth	15 cm	2 nos.
44.	File round second cut	20 cm	4 nos.
45.	File square second cut	15 cm	4 nos.
46.	File square second cut	25 cm	4 nos.
47.	Feeler gauge	10 blades	1 set
48.	File triangular second cut.	20 cm	4 nos.
49.	File triangular second cut.	15 cm	4 nos.
50.	File flat second cut.	30 cm	4 nos.
51.	File flat bastard	20 cm	4 nos.
52.	File flat bastard.	30 cm	4 nos.
53.	File half round second cut.	25 cm	4 nos.
54.	File Swiss type needle.	set of 12	2 sets
55.	File round bastard.	30 cm	4 nos.

56.	File hand second cut.	15 cm	8 nos.
57.	Card file.		4 nos.
58.	Oil Stone	15 cm x 5 cm x 2.5 cm	4 nos.
59.	Stone carborandum	15 cm x 5 cm x 5 cm x 4 cm.	2 nos.
60.	Oil Can.	0.25 litres	2 nos.
61.	Pliers combination	15 cm	2 nos.
62.	Soldering Iron	350 gm.	2 nos.
63.	Blow Lamp	0.50 liters.	2 nos.
64.	Spanner D.E.	6 -26 mm set of 10 pcs.	2 set.
65.	Spanner adjustable	15 cm	1 nos.
66.	Interchangeable ratchet socket set with a 12 mm driver, & attachments.	sized10-32 mm set of 18 socket	1 set
67.	Box spanner set with Tommy bar.	6-25 mm set of 8	1 set
68.	Glass magnifying	7 cm	1 nos.
69.	Clamp toolmaker	5 cm and 7.5 cm set of 2.	2 nos.
70.	Clamp “C”	5 cm	2 nos.
71.	Clamp “C”	10 cm	2 nos.
72.	Hand Reamer adjustable cover	max 9 ,12,18mm – set of 3	1 set
73.	Hand Reamer taper	4 -9mm set of 6 OR 4 -7 mm set of 4.	1 set
74.	Reamer parallel	12 – 16mm set of 5.	1 no.
75.	Scrapeer flat	15 cm.	4 nos.
76.	Scrapeer triangular	15 cm.	2 nos.
77.	Scrapeer half round	15 cm.	2 nos.
78.	Chisel cold cross cut	9 mm	2nos
79.	Chisel cold flat	19 mm	2 nos.
80.	Chisel cold round nose.	9 mm	2 nos.
81.	Stud Extractor EZY – out		2 nos.
82.	Combination Set.	30 cm	2 nos.
83.	Micrometer outside.	0 – 25 mm	2 nos.
84.	Micrometer inside with extension rods.	25 – 50 mm	1 no.
85.	Vernier caliper	15 cm	2 no.
86.	Vernier height gauges.	30 cm	1 no.
87.	Vernier bevel protractor.		1 no.
88.	Screw pitch gauge.		1 no.
89.	Wire gauge, metric standard.		1 no.
90.	Drill twist Taper Shank	12 mm to 25 mm x 1.5.	1 no

91.	Drill chuck	12 mm.	1 no.
92.	Pipe wrench	40 cm	1 no.
93.	Pipe vice	100mm	1 no.
94.	Adjustable pipe die set cover pipe	size 15, 20, 25,32,38,50 mm with die stock	1 no.
95.	Wheel dresser	One for 4 units	1 no
96.	Machine vice.	10 cm	1 no.
97.	Machine vice.	15 cm	1 no.
98.	Sleeve drill Morse.	0 – 1, 1 – 2, 2 – 3	1 Set
99.	Vice bench jaws.	12 cm	20 nos.
100.	Vice leg jaw.	10 cm	2 nos.
101.	Lathe tools H.S.S. tipped set.		2 nos.
102.	Lathe tools bit.	6 mm x 75 mm	2 nos.
103.	Lathe tools bit.	8 mm x 75 mm	2 nos.
104.	Lathe tools bit.	10 mm x 85mm	2 nos.
105.	Arm strong type tool bit holder R.H.		2 nos.
106.	Arm strong type tool bit holder L.H.		2 nos.
107.	Arm strong type tool bit holder straight.		2 nos.
108.	Bench working.	240 x 120 x 90 cm	4 nos.
109.	Almirah.	180 x 90 x 45 cm	2 nos.
110.	Lockers with 8 drawers.	standard size	3 nos.
111.	Metal rack	182 x 182 x 45 cm	1 no.
112.	Instructor Table		1+1 no.
113.	Instructor Chair		1 +1no.
114.	Black board with easel.		1 no.
115.	Fire extinguisher (For 4 Units)		2 nos.
116.	Fire buckets.		2 nos.
117.	Machine vice.	100mm	2 nos.
118.	Wing compass.	25.4 cm or 30 cm	2 nos.
119.	Hand hammer with handle.	1 kg.	2 nos.
120.	Torque wrench	14 to 68 Nm	1 no.
121.	Class room Chair		20 nos
122.	Class Room table		20nos
123.	Computer Chair		4+1
124.	Computer Table		4+1
125.	Desktop computer/Lap top with related MS office software		4+1

126.	Discussion Table	8' x 4' x 2½'	2
127.	First- aid box		As required
128.	Instructional Material – Ref. books		As required
129.	Internet connection with all accessories		As required
130.	Laser printer		1
131.	LCD projector/ LED /LCD TV	42"	1
C : GENERAL MACHINERY INSTALLATIONS			
132.	SS and SC centre lathe	(all geared) with Minimum centre height 6"/150 mm & length 4.5"/ 1400 mm along with 3, 4 jaw chuck, auto feed system, coolant arrangement, lightening lamp, taper turning attachment, safety guard & standard accessories.	2 Nos.
133.	Drilling machine pillar sensitive with swivel table motorized with chuck & key.	0-20 mm cap	1 no.
134.	Drilling machine bench sensitive motorized with chuck and key.	0-12 mm cap	2 nos.
135.	D.E. pedestal Grinding machine	With 200mm diameter wheels rough and smooth with twist drill grinding attachment.	1 no.
136.	Transformer welding set continuous welding current, with all accessories and electrode holder	150 amps	1set
137.	Oxy -acetylene gas welding set equipment with hoses, regulator and other accessories.		1set

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: FITTER
LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES

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 (700mm x500 mm) IS: 1444		20+1 set
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	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.		

FORMAT FOR INTERNAL ASSESSMENT

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

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