DRAUGHTSMAN MECHANICAL

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

DRAUGHTSMAN MECHANICAL

(Revised in 2018)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL - 5

Developed By

Ministry of Skill Development and Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091

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. .....
2. .....

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

Co-ordinator for the course: Sh. .....

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Expert Group Designation
1.			Expert
2.			Expert
3.			Expert

Sl. No.	Name & Designation Shri/Mr./Ms.	Organization	Mentor Council Designation
Expert group on restructuring of Apprenticeship Training Modules			
1.	B. V. S. Sesha Chari, Director	CSTARI, Kolkata	Chairman
2.	L. K. Mukherjee, DDT	CSTARI, Kolkata	Member
3.	Nirmalya Nath Asstt. Director (Trg.)	CSTARI, Kolkata	Member
4.	Ashis Kumar Mondal, ADT	CSTARI, Kolkata	Member
5.	R. N. Manna, T.O.	CSTARI, Kolkata	Member

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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.

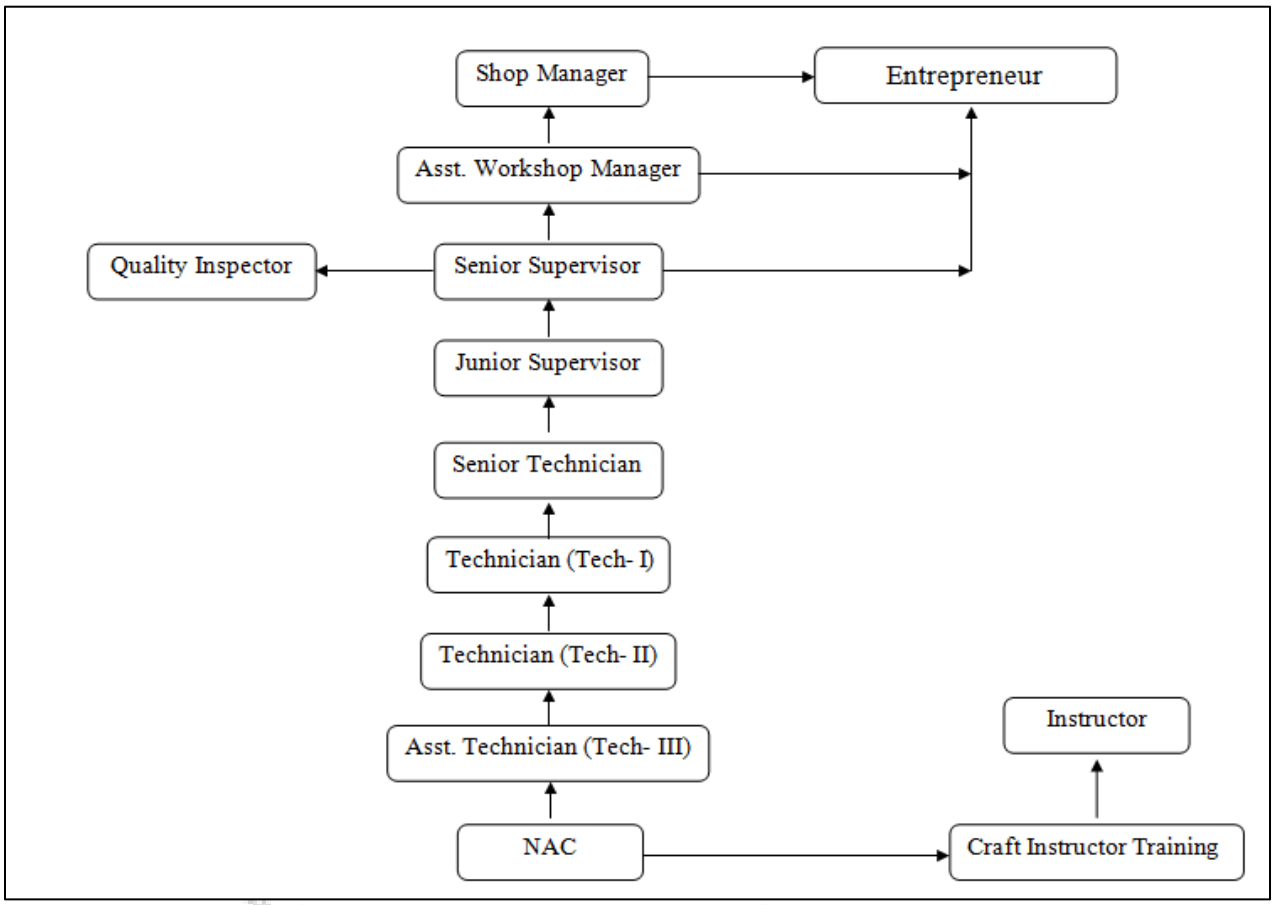
Draughtsman Mechanical trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, 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:

- 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: -

Sl. No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	890
2	Professional Knowledge (Trade Theory)	
3	Workshop Calculation & Science	40
4	Employability Skills	110
	Total (including Internal Assessment)	**1040**

B. On-Job Training:-

Notional Training Hours for On-Job Training: 3120 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	• Good skill levels in the use of hand tools, machine tools and workshop equipment • 70-80% tolerance dimension/accuracy

work which demonstrates attainment of a reasonable standard of craftsmanship.	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:

Draughtsman, Mechanical responsible to develop mechanical design from concept through detailed drawing, understand and help to develop company prepares drawings of machines, plants, mechanical components, equipments, etc. from sketches, notes, data or sample for purposes of manufacture or repairs. Takes instructions from **Mechanical Engineer** and calculates dimensions as required, from available materials (notes, data etc.) or sample. Draws to scale detailed drawings, assembly drawings, showing plan, elevations, sectional views etc. according to nature of work and operations required. Prints (writes) dimensions, tolerances, material to be used and other details to gives clear picture and facilitate understanding. Maintains copies of drawings and makes blue prints. Detail drawings in both AutoCad and Inventor that meet or exceed the clients' needs, budgets and expectations. Update and modify drawings in both AutoCad and Inventor. All information is to be clearly presented to both members of the project team and clients in written, oral or drawing format. May specialise in making drawings of jigs and tools and be designated accordingly. Assist in field measurements and inspections. Convert IDW files to DWG files. Update the resulting DWG files to match the original IDW files. Create objects on 3D modeling space in CAD viewing printable drawing and plotting them.

In addition Draughtsman-Mechanical has 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.

Reference NCO:

i) **NCO-2015: 3118.0402 -** Draughtsman, Mechanical
ii) **NCO-2015: 3118.0401 –** Draught person, Mechanical

4. NSQF LEVEL COMPLIANCE

NSQF level for Draughtsman Mechanical 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 Draughtsman Mechanical 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	DRAUGHTSMAN MECHANICAL
NCO - 2015	3118.0402 Draughtsman Mechanical 3118.0401 Draughtperson Mechanical
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.
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 Draughtsman Mechanical Apprenticeship	1. Draughtsman Mechanical

Distribution of training on Hourly basis: (Indicative only)
A. Basic Training

Total hours (40 hrs./ wk X 26 wks.)	**Trade practical**	**Trade theory**	**Work shop Cal. &Sc.**	**Employability skills**
1040 Hours	890 Hours		40 Hours	110 Hours

B. On-Job Training – 3120 Hrs.

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 Draughtsman Mechanical 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 preparing drawing with instruments.
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Construct different Geometrical figures using drawing Instruments.
4. Draw orthographic Projections giving proper dimensioning with title block using appropriate line type and scale.

5. Construct free hand sketches of simple machine parts such as tool post of a Lathe with correct proportions.
6. Draw Sectional views showing orthographic, isometric and oblique projections.
7. Develop surface and interpenetration of solid in orthographic projection.
8. Draw Different types of fasteners and locking devices as per BIS convention.
9. Acquire basic knowledge on tools and equipment of Allied trades viz. Fitter, Turner, Machinist, Sheet Metal Worker, Welder, Foundry man, Electrician and Maintenance Motor Vehicles and apply it in day to day work.
10. Draw different Couplings and Bearings with Tolerance Dimension and indicating surface finish symbol.
11. Create objects on Drawing Space using toolbars, commands and menus in CAD application software.

Block – II

12. Customize object drawing on CAD using Toolbars viz. Draw, Modify, and Dimensioning. Format Layer and Style.
13. Draw detail and assembly Drawing of machine parts viz., Pulleys, Pipe fittings, Gears and Cams using CAD.
14. Draw IC Engine Parts with dimensioning and tolerance using CAD, applying quality concept.
15. Draw detail and assembly of Manufacturing and Process tools applying conventional signs & symbols using CAD.
16. Measure and inspect different components by using gauges and measuring instruments and check for accuracy without any assistance.
17. Create and plot a machine part with assembly, specify detail in Title Block and layout space in CAD.
18. Create production drawing of machine part.
19. Create objects using 3D Modelling Space and Print Preview and Plotting in CAD.

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 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	
<u>Block-I & II</u>	
*Assessment Criteria for each specific learning outcome mentioned under block – I & block – II must broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc.) and **Checking/ Testing** to ensure functionality during the assessment of each outcome.*	

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	Safety: - its importance, classification, personal, general, workshop and job safety. Occupational health and safety. Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Preventive measures for electrical accidents & steps to be taken in such accidents. Importance of housekeeping & good shop floor practices. Disposal procedure of waste materials like cotton waste, metal chips/burrs etc. Fire& safety: Use of Fire extinguishers.	Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures. Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE). Response to emergencies eg; power failure, fire, and system failure. Accidents- Definition types and causes. First-Aid, nature and causes of injury and utilization of first-aid. Introduction to 5S concept & its application. Fire: - Types, causes and prevention methods. Fire Extinguisher, its types. Define environment, environment Pollution, Pollutants, type of Pollution (Air pollution, water pollution, soil pollution noise pollution, thermal pollution, radiation. Global warming its causes and remedies. Industrial Waste its types, sources and waste Management.
2.	Practice in using instruments. Drawing of straight and curved lines, Drawing angles, circles etc. Prepare a figure containing all types of lines. Layout of drawing sheet as per B.I.S. Folding of prints for filing Cabinets or binding as per SP: 46-2003	Nomenclature, description and use of drawing instruments & various equipments used in drawing office. Their care and maintenance. Different types of Lines and their meanings & their uses. Lay out of a drawing sheet as per B.I.S.

3.	Block letters & numerals. Single & double stroke ratio 7: 4, 5: 4, free hand lettering practice. Preparation of Title Block as per Industry Drawing sheet.	Type of lettering proportion and spacing of letters and words. Knowledge of stencil lettering.
4.	Draw lines and object representing scale factor. Draw a vernier scale with a reading.	Constructions of different types of scales, their appropriate uses, Principle of R.F, diagonal & vernier.
5	Plane geometrical construction of triangle, polygons, Circles, ellipse and parabola.	Terms & definitions- polygons and circles. Methods to draw geometrical figures.
6.	Projection of lines and laminar planes. Projection of solids- prism, cones, pyramids and their frustums.	Projections and orthographic projection. First angle and third angle projection. Principal of orthographic projection. Projection of solids like prism, cones, pyramids and frustums in various position.
7.	Dimensioning technique – presenting on solid geometrical figure. Conventional sings and symbols. Different types of section lines and abbreviations as per B.I.S.	Units of dimensioning, system of dimensioning, Method of dimensioning & common features. Section lines of different materials, conventional signs, symbols & abbreviations, hatching.
8.	Sectional views – Different types of solid section.	Importance sectional views. Types of sectional views & their uses. Parts not shown in section.
9.	Development of surfaces of geometrical blocks.	Definition of development, its need in industry & different method of developing the surfaces.
10	Isometric projection of geometrical solids. Oblique projection of solids. Perspective projection of solids.	Principle of isometric projection, Difference between Isometric view & Isometric projection. Isometric scale. Dimensioning an isometric drawing. Principle and types of oblique projection. Types of perspective projection Fundamental concept and definition, Location of station point.
11	Drawing bolts, nuts and studs, Locking devices, machine screws, set screw and Foundation bolts with BIS convention. Drawing welded joints and riveted joints, keys, cotters and pins with BIS conventions.	Types of bolts and studs, and their proportion, uses. Different types of locking devices and their specification. Different types of foundation bolts. Description of Riveted joints. Welded Joints and their representation (Actual and Symbolic) on drawing as per BIS.
12	Intensive free hand sketching of m/c	Importance of free hand sketching,

	parts along with projection of simple machine parts in 1st angle projection. Projection of machine parts drawn in the above exercise in 3rd angle projection by taking physical measurement.	machine drawing. Material and equipment required in sketching. Method of using precision measuring instrument such as inside & outside micrometers, depth gauges , vernier, calipers, dial indicators, slip gauges , sine bars, universal bevel protractor, etc.
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.	Symbols for machining and surface finishes (grades and micron values) Working drawing of(muff coupling, flanged coupling, friction grip coupling, pin type flexible coupling, universal coupling) couplings.	Limits, fit, tolerance. Dimensional tolerance, geometrical tolerance. Indications of symbols for machining and surface finishes on drawing(grades and micron values) Production of interchangeable parts, geometrical tolerance. Familiarization with IS: 919-1993 (R1998), IS:2709-1982. Couplings, necessity of coupling, classification of couplings.
2.	Half sectional drawing of a simple bush bearing and foot step bearing, Plummer block.	Use of a bearing, types of bearing, frictional and anti frictional bearings. Parts of anti frictional bearings (ball, roller, thrust ball, needle & taper roller)
3.	Pulleys-solid, stepped and built up pulleys. Pulleys-pulley with different types of arms, rope pulleys, belt pulleys and drive.	Belts-power transmitted by belt. Materials of belts slip and creep Velocity of belt. Arc of contact. Simple exercise in calculation of belt speeds, nos. Of belts needed in V-belt drive, velocity, pulley ratio etc. Standard pulleys width of pulley face, velocity ratio chain drive.
4.	Working drawing of gears such as spurs helical, bevel & worm, worm and worm wheel.	Use of gears in transmission of power. Different types of gears. Cast gears and machined gears.
5.	Cams with different motions to followers, different types of follower Drawing.	Use of Cams in industry. Types of cam, kinds of motion, displacement diagrams. Terms used in cam. Types of followers.
6.	Sketching & Assembly Drawing of Tail stock, sapping machine tool post and machine vice.	Brief Description of lathe, milling, shaping slotting and planning machines; Quick return mechanism of these machines.
7.	Sectional drawing of pipe fittings - flanges, unions, valves etc. Typical Piping layout drawing with welded, flanged and screwed fittings. Sectional view of different types of pipe joints.	Piping materials and specifications of W.I. & Steel pipes, Pipe threads, Specifications of pipe fittings. Brief description of different pipe joints.
8.	Preparation of Engineering graphs and charts. Reproduction and duplication of Engineering Drawing. Numbering and preservation of	Classification of charts, graphs and diagram. Blue prints, Plotter print, photo copies, Xerox printing.

	drawing.	Method of numbering and preserving of drawings. Preparation of the Master register of the drawing.
9.	Introduction to Auto CAD, Auto CAD main Menu, screen menu, command line, model space Drawing layouts, Tool bars, File creation, Save, Open existing drawings, creation of Drawing Sheet as per ISO.	Introduction to Auto CAD Advantages of using AutoCAD
10.	Related Exercises using Absolute Co-ordinate system, Polar Co-ordinate System and Relative Co-ordinate System, Exercise using commands set of tools in Draw, Modify and Dimension. Creating drawing using AutoCAD shortcut keyboard command.	Absolute Co-ordinate system , Polar Co-ordinate System and Relative Co-ordinate System Knowledge of Workspace in drawing space: 2D classic, Drafting & annotation, 3D modeling, etc. Use of drawing utilities, Snap, Ortho, Grid, Osnap, Polar tracking. Customization of working environment with tool using shortcut key, menu driven or ribbon setting.
11.	CAD: Practice using Creating templates, Inserting drawings, Layers and Modify Layers. Viewing Drawing in viewports in layout space.	Knowledge of model space & layout space, how to create viewport & template. Managing drawing in page setup manager.
12.	Advanced application of AutoCAD exposure of 3D modeling.	Introduction to 3D, 3D primitives, Extrude, Revolve command. Setting User co-ordinate Systems, Rotating, Plotting, Print preview
13.	**Assessment/Examination 03days**	

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

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I	
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**
1.	**Unit**: Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units
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.
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.
4.	**Average :** Problems of Average. **Ratio &Proportion** : Simple calculation on related problems.
5.	**Mass, Weight and Density**: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density.
6.	**Percentage**: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.
7.	**Forces:** - 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.
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.
9.	**Algebra** : Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables). - Circular Motion: Relation between 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.

Block – II	
Sl. No.	**Workshop Calculation and Science (Duration: - 20 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.
2.	**Friction** and its application in Workshop practice.
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.
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.
5.	**Heat treatment** – Necessity, different common types of Heat treatment.
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	**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. Practice and understand precautions to be followed while preparing drawing with instruments.
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Construct different Geometrical figures using drawing Instruments.
4. Draw orthographic Projections giving proper dimensioning with title block using appropriate line type and scale.
5. Construct free hand sketches of simple machine parts such as tool post of a Lathe with correct proportions.
6. Draw Sectional views showing orthographic, isometric and oblique projections.
7. Develop surface and interpenetration of solid in orthographic projection.
8. Draw Different types of fasteners and locking devices as per BIS convention.
9. Acquire basic knowledge on tools and equipment of Allied trades viz. Fitter, Turner, Machinist, Sheet Metal Worker, Welder, Foundry man, Electrician and Maintenance Motor Vehicles and apply it in day to day work.
10. Draw different Couplings and Bearings with Tolerance Dimension and indicating surface finish symbol.
11. Create objects on Drawing Space using toolbars, commands and menus in CAD application software.

Block – II

12. Customize object drawing on CAD using Toolbars viz. Draw, Modify, and Dimensioning. Format Layer and Style.
13. Create objects using 3D Modelling Space and Print Preview and Plotting in CAD.
14. Draw detail and assembly Drawing of machine parts viz., Pulleys, Pipe fittings, Gears and Cams using CAD.
15. Draw IC Engine Parts with dimensioning and tolerance using CAD, applying quality concept.
16. Draw detail and assembly of Manufacturing and Process tools applying conventional signs & symbols using CAD.
17. Measure and inspect different components by using gauges and measuring instruments and check for accuracy without any assistance.

18. Create and plot a machine part with assembly, specify detail in Title Block and layout space in CAD.
19. Create production drawing of machine part.

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

DRAUGHTSMAN MECHANICAL		
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 20 Apprentices)		
A : TRAINEES TOOL KIT:		
Sl. No.	**Name of the items**	**Quantity (indicative)**
1.	Draughtsman drawing instrument box containing 20 Nos. Compasses with pencil point, point driver, interchangeable, Divider pen point interchangeable, divider spring bow, pen Spring bow lengthening bar, pen drawing liner, screw driver Instrument, tube with lead.	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.	French-curves (set of 12 celluloid)	4 nos.
5.	Mini drafter	20+1 set
6.	Drawing board (700mm x500 mm) IS: 1444	20+1 set
B : TOOLS INSTRUMENTS AND GENERAL SHOP OUTFITS		
7.	Chest of drawer 8 drawers(Standard)	2 Nos.
8.	Draughtsman table	20 Nos.
9.	Draughtsman stool	20 Nos.
10.	Software: MS- office latest version, CAD with latest Licensed version, Latest Version of SOLIDWOKS, AUTODESK INVENTOR, CATIA & PRO-E (CREO-2)	8 users
11.	White Board for using LCD projector(optional)	1 No.
12.	Instructor Table	1 No.
13.	Instructor Chair	2 Nos.
14.	Almirah steel	1 No.
15.	3D Visualiser	1 No.
16.	Computer table	8 Nos.
17.	Computer chairs	16 Nos.
18.	Table for server, printers	1 No. each
19.	External storage device (8 GB)	2 Nos.

C : GENERAL MACHINERY INSTALLATIONS		
20.	Computer Latest version compatible for running CAD software, preloaded with windows and 20" colour Monitor.	8 Nos
21.	Sever (True dedicated sever)	1 No.
22.	Plotter (Max. A0 size)	1 No.
23.	Laser Jet printer latest model	1 No.
24.	UPS - 5 KVA	2 Nos.
25.	LCD projector /OHP	1 No.

Note: In case of basic training setup by the industry the tools, equipment and machinery available in the industry may also be used for imparting basic training.

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

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

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

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