OPERATOR ADVANCE MACHINE TOOL

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

OPERATOR ADVANCE MACHINE TOOL

(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 express 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. Maruti India Ltd., Gurugram
2. Volkswagan Academy, Pune
3. OCL Ltd. (Dalmia Group), Odisha
4. Bharat Heavy Electricals Ltd., Ranipet, Tamil Nadu
5. TATA Motors, Pune
6. JBM Group, Chennai
7. MTAB Technology (P) Ltd., Chennai
8. Seinumero, Pune

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

Co-ordinator for the course: Sh. Nirmalya Nath., ADT

Sl. No.	Name & Designation Sh./Mr./Ms.	Organization	Remarks
1.	N. Nath, ADT	CSTARI, Kolkata	Expert
2.	R. N. Manna, T.O.	CSTARI, Kolkata	Expert
3.	N.M. Kajale, Principal,	Govt. ITI Velhe, Distt: Pune.	Expert
4.	Samir Sarkar, T.O.	ATI, Kolkata	Expert
5.	Madhusudan Karmakar, V.I.	ATI, Kolkata	Expert

CONTENTS

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.

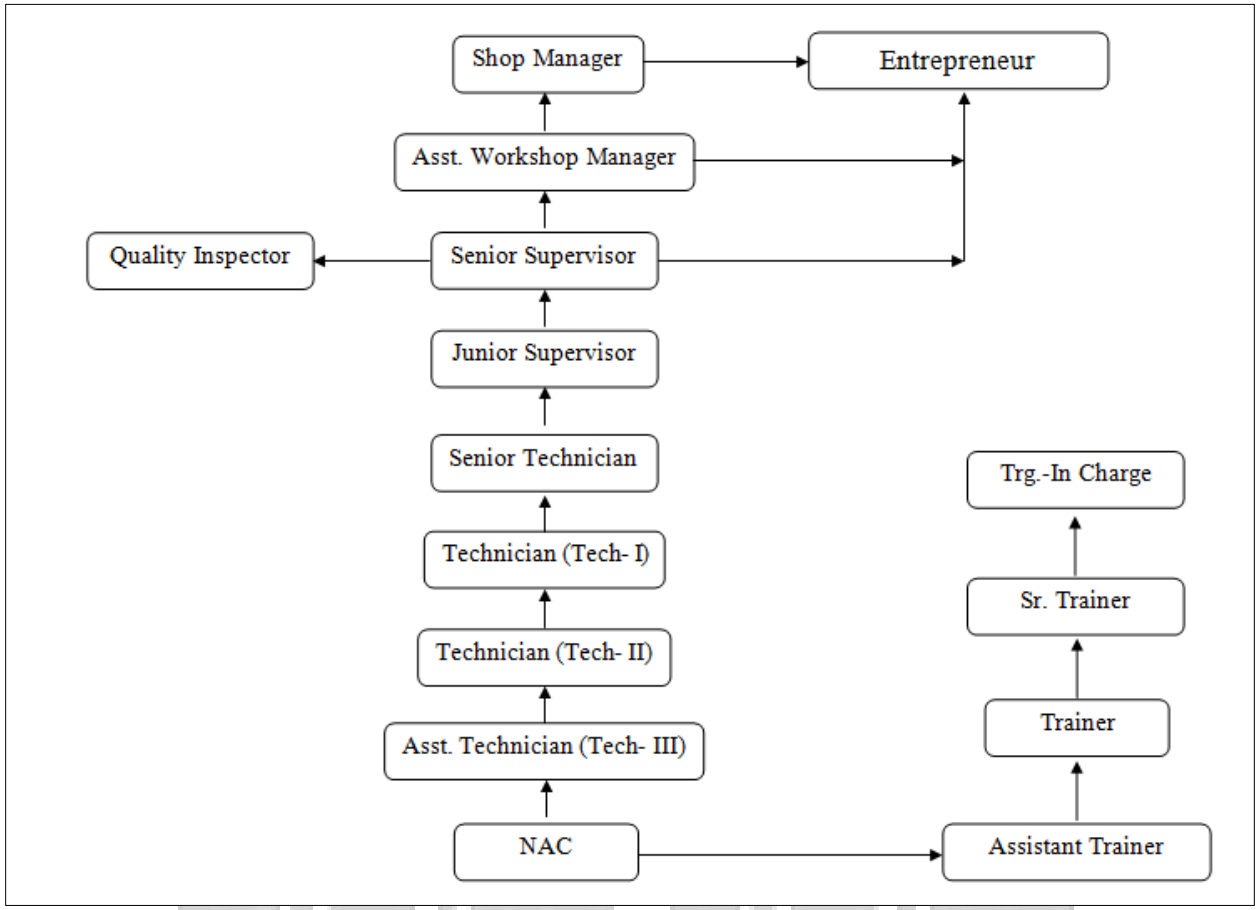
Operator Advance Machine Tool trade under ATS is one of the most popular courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills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

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

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

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

B. On-Job Training:-

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

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

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

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

C. Total training hours:-

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

2.4 ASSESSMENT & CERTIFICATION:

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

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training institute have to maintain individual *trainee portfolio* as detailed in assessment guideline (section-2.4.2). 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 (section-2.4.2) 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	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment • Below 70% tolerance dimension/accuracy

demonstrates attainment of an acceptable standard of craftsmanship.	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:

Operator Advance Machine Tool , operates various types of power driven metal cutting or grinding machines for cutting and grinding metal. Studies drawings or measures out sample with appropriate measuring instruments to note different dimensions and sequence of operations required. Selects metal piece and marks it or gets it marked for machining operations required. Fastens metal in chuck, jig or other fixture and respective tool or cutter, according to sequence of operation, on appropriate machine (lathe, shaper, milling, slotting, drilling, grinding). Makes metal articles to required specifications using lathe and cutting tools. Studies drawings and other specifications of parts to be made. Checks machine setting or sets it for stipulated machine operations. Selects machine feed and speed and starts machine. Controls flow of coolant (cutting lubricant) and manipulates hand wheels or applies automatic controls to feed tool to metal or metal to tool. Observes cutting or grinding both from marking and machine readings, checks for dimensions as necessary and removes parts when machining is completed, checks completed part with measuring instruments and gauges to ensure prescribed accuracy. Makes adjustments if necessary and repeats operations, as required, on same or other machines. May assist in setting up machine for repetitive work, change tools, make simple adjustments, clean and oil machine. Demonstrate the operation of both CNC Machining Center (3-axes) and CNC turning machine and producing components as per drawing by preparing part programmes.

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. Perform TPM (Total Production Management), TQM (Total Quality Management).

Reference NCO & NOS:

i) NCO-2015: 7223.0500
ii) NCO-2015: 7223.0601
iii) NCO-2015: 7223.0800
iv) NCO-2015: 7223.1100
v) NCO-2015: 7223.1201
vi) NCO-2015: 7223.1300
vii) NCO-2015: 7223.1500
viii) NCO-2015: 7223.1600

4. NSQF LEVEL COMPLIANCE

NSQF level for Operator advance Machine Tool trade under ATS: **Level 5**

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

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

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

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

The Broad Learning outcome of Operator Advance Machine Tool trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

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

5. GENERAL INFORMATION

Name of the Trade	Operator Advance Machine Tool
NCO-2015	7223.0500, 7223.0601, 7223.0800, 7223.1100, 7223.1201, 7223.1300, 7223.1500, 7223.1600
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 Apprentices	The apprentices will be selected as per Apprenticeship Act amended time to time.
Instructors Qualification for Basic Training	As per ITI instructors qualifications as amended time to time for the specific trade.
Infrastructure for Basic Training	As per related 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 Operator Advance Machine Tool Apprenticeship	1. Turner 2. Machinist 3. Operator Advanced Machine Tools

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 Operator Advance Machine Tool 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. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.) emphasizing more on housekeeping.
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Perform marking out the components for filing, drilling, and allied operations.
4. Blueprint reading of technical documents - part, assembly drawings

5. Produce finished components by performing different shaping & slotting operations and check for Quality check for finish result.
6. Produce finished components by performing different planing operation and check for accuracy. (Optional)
7. Produce finished components by performing different lathe & milling operations and check for accuracy.
8. Perform preventive maintenance of lathe, shaping, slotting, planning, milling and grinding machines.
9. Set and operate surface grinder to produce components and check the job accuracy.
10. Set and operate cylindrical grinder to produce components and check the job accuracy.
11. Produce different components using non conventional machine.

B. BLOCK – II (09 months)

12. Produce different forms of threads viz., "V", Square and Acme thread applying basic methods, machine tools, materials and information.
13. Work out and apply cutting parameters for different turning, drilling& milling operations with different work and tool material for producing quality output.
14. Grind Form tool and parallel & stepped using grinding machine with accuracy using appropriate tools & materials and with required quality.
15. Manufacture different components viz., V-block, Key-way, concave & convex surface, horizontal, angular, vertical, male-female T-slot & dovetail, multiple jobs at a time by determining use of shaping /and slotting /and planning machine.
16. Produce different components by performing different operation viz., step milling, straddle milling, square & hexagonal milling, T-slot & dovetail milling using milling machine with clear choice of procedures.
17. Demonstrate practical skills to ream the drilled hole using radial drill machine.
18. Make different components viz., spur gear, helical, Bevel, worm & worm wheel, rack & pinion by setting the milling machine.
19. Produce different components viz., end mill/drum cam, face cam, plate cam using milling machine and by applying quality concept.
20. Manufacture different components viz., spline (external), straight fluted reamer, cylindrical cutter, slab milling cutter, twist drill using milling machine with clear choice of procedures.
21. Process planning - machining sequence, cutting tools selection, cutting parameters, work holding devices.
22. CAD/CAM software operation, DNC operation. Co ordinate measurement, care & upkeep of machine.

23. CNC part programming, operations and machine settings, verification (simulation of CNC part programs and machine simulation) and Preventive maintenance of CNC machines.
24. Set and operate CNC Vertical Machining Centre (3 – axes) to produce components by preparing part programmes & applying range of cognitive and practical skills.
25. Set and operate CNC lathe machine to produce components by preparing part programmes and carry out basic preventive maintenance of CNC machines.
26. Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.

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

Block-I & II (Section:10)

*Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under **block – I & block – II**(section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of **Planning** (Identify, ascertain, estimate etc.); **Execution** (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3)Desired Mathematical Skills and some skill of collecting and organizing information, communication) and **Checking/ Testing** to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.*

8. SYLLABUS

BASIC TRAINING (Block – I)

Duration: (03) Three Months

Week No.	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
1.	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.	Identification of tools & equipments as per desired specifications for marking & sawing(Hand tools , Fitting tools & Measuring tools) Selection of material as per application Visual inspection of raw material for rusting, scaling,	Hand tools and its importance, steel rule, Try square, chisel, surface gauge and care & maintenance, Hacksaw frame, blades. Classification and types of chisels, files & uses, vices - its constructions and uses. Hammers and its types. Related safety. Marking block, Steel rule, and calipers-

	corrosion etc. Uses of marking tools, Punch, Try square & basic measuring tools, caliper, steel rule. Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions, sawing different types of metals of different sections. Chipping flat surfaces and grinding various angles to chisels, filing flat surface. Grooving with Hammer and chisel.	different types and uses. Combination set-its components and uses. Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, Types & uses.
3.	Introduction to Shaping machine and its construction. Setting of strokes, tools, job on table. Safety points to be observed while working on a shaper. Setting of vice, setting of block on vice checking accuracy. Machining of Rectangular, Hexagonal block, steps, with the use of Basic tools as per sketch checking with caliper & steel rule, angle protractor.	Outside micrometer, its types and construction, parts, reading use, care and maintenance. Study about Depth gauge, micrometers and dial test indicator - their parts and construction. Introduction of shaper, types, classification, General principles of power transmission on shaping mechanism. Shaping parts, construction use of parts, quick return mechanism ratio etc. Various tools of shaping machine and their angles and importance of angles.
4.	Shaping "V" blocks with slides, measurement of 'V' groove with vernier bevel protractor, measurement of slots by vernier caliper with 0.02 mm accuracy. Shaping Tee slots, shaping angular surfaces.	Various methods of holding jobs, use of clamps, nuts & bolts V- blocks, angle plates shaping operations, their importance. Tool head - its parts and application, function of each part of tool head. Shaping tools and types. Speed, feed, depth of cut.

	Cutting of external keyway on shaper.	Surface finish as per ISI system. Dovetail measurement external and internal by vernier bevel protractor. Checking of Dovetail by roller method.
5	General introduction to slotting. Safety points to be observed while working on a slotter. Slotting a rectangular job checking and measuring with gauges & precision measuring instruments.	Slotter-principle, construction, details, driving mechanism, quick return motion and speed ratio. Safety precaution comparative study with a shaping machine. Classification of slotting machine. Job holding devices-vice, clamps, V-block, parallel block etc. Slotting tools different types of work tool angles comparison of tool shape with that of shaper.
6	Practice on slotting key ways on pulley-Internal and external slotting irregular shaped jobs having curved surfaces.	Use of tool with holder for internal operations. Precautions to be observed during slotting internal operations. Introduction to coolant & lubricant-difference between them, types and uses of each. Use of circular marks on the table for slotting curves. Introduction to Planing M/c. parts, types, constructions, details of Driving mechanism of planer, quick return motion etc.
7-8	Introduction to lathe. Holding of round job in an independent chuck and truing it. Holding the tool in a tool post, centering the job with the tool. Facing & drilling. Parallel turning between centers, parting off, chamfering using roughing, finishing and parting off	Introduction to lathe. Its types, engine lathe construction, detail function of parts size and specification. Safety points to be observed while working on a lathe. Lathe tools their angles & uses. Driving mechanism, speed and feed mechanism & lathe accessories.

	tools.	
9.	Holding the job in three jaw chuck truing, centering facing. Step turning undercutting, knurling drilling and boring. Taper turning by swiveling compound rest, setting the compound rest to correct degree, checking the tool height, clamping the saddle for no longitudinal movement, checking up with precision instruments.	Chucks-different types of job holding devices on lathe and advantages of each type. Mounting and dismounting of chucks. Taper introduction, types and uses. Calculations of tapers. Measurement of taper by sine bar and slip gauges. Different thread forms their related dimensions and calculations screw cutting in a lathe. Measurement of threads by three wire methods.
10.	Introduction to milling machine, demonstration on working principle, setting of job, setting of cutter in arbor, setting of vice on table. Safety points to be observed while working on a milling machine. Sequence of milling six faces of a solid block. Checking the accuracy with the help of try-square scribing block and vernier height gauge. Step milling using side and face cutter checking with micrometer.	Milling machine importance of milling machine, types and specification of milling machine, driving and feed mechanism of milling machine. Classification & different types of milling cutters & their use. Parts and nomenclature. Vernier height gauge construction, graduations vernier setting & reading, vernier bevel protractor, construction graduation setting and reading. Care and maintenance of vernier height gauge and bevel protractor.

11	Straddle and gang milling operations including up-milling and down milling. Milling concave and convex surfaces. Introduction to indexing head types, setting and aligning of indexing head with reference to job on milling machine. Milling square and hexagonal job by simple indexing method.	Different milling operations plain-face, angular, form, slot, gang and straddle milling etc. Up and down milling. Different types of milling attachments and their uses. Indexing-introduction & types. Indexing head-constructional details, function of indexing plates and the sector arms. Calculation for various types of indexing.
12.	Milling dovetail and 'T'slots both male & female matching each other. Milling of spur gear. Introduction to grinding machine surface grinder, cylindrical grinder. Driving and feed mechanism, job holding devices mounting of wheels. Wheel balancing & truing. Grinding of parallel and stepped jobs. Dressing of grinding wheels.	Gear introduction, use and type. Elements of a spur gear. Gear tooth of each forms types, merits and demerits of each. Spur gear calculations, curves and their uses. Selection of gear cutter type and form & various methods of checking gear and its parts. Grinding machine introduction types, specification, their parts and functions & uses. Safety points to be observed while working on a Grinding machine. Types of Abrasives and their uses, Glazing and loading of wheels. Explain the importance and necessity of quality.
13	**Revision & Internal Assessment**	

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	Checking of alignment of lathe centers and their adjustments. Center drilling, step turning between centers recessing and chamfering & measurement with vernier caliper. Taper turning by taper turning attachment. Cutting V thread external and internal in a lathe. Checking up with screw pitch gauge. Cutting square thread external & internal on a lathe. Cutting square threads (right hand only) on a lathe-checking with thread gauge-grinding of tool and setting in correct position.	Turning of taper by taper turning attachment advantages and dis-advantages taper calculations. Screw cutting on a lathe. Terms relating screw thread major/ minor diameter pitch and lead of the screw, depth of thread simple gear train and compound gear train change gears for fractional pitches. Difference between single and multi-start threads-their uses merits and demerits. Broach - its types and uses. Square thread its form and calculation of depth, core dia, pitch dia. Acme thread its forms use and calculations.
2.	Exercise on use of pillar drill in drilling, counter sinking, counter boring. Spot facing and use of spot facing tools. Further practice of drilling of Radial drills. Practice of reaming on drilled holes.	Square threads-its forms and calculations of depth, core dia, pitch dia, Acme threads-its forms, use and calculations. Face plate- its construction safety precaution in holding jobs on face plate. Pillar drill machine constructional details, functions of parts. Application of pillar drill. Radial drills function parts etc. Reamer- parts, types, uses. Special tools – use and precautions to be observed for shaping internal keyways

		dovetails & 'T' slots. Various material for single point cutting tools, tipped tools, their brazing and grinding process. Tool angles and their effect on cutting various materials.
3.	Shaping cross dovetails mating jobs male and female. Grinding of form tools.	Cutting speed, feed, depth of cut for slotting, shaping and time calculation. Checking of dovetail grooves with vernier caliper and roller. Their calculations and use of sine bar, slip gauge and dial test indicator. Properties of metals general idea of physical, mechanical properties of metals, colour, weight, hardness toughness, malleability, ductility their effect on machine ability. Use of radius gauges and template. Introduction to jigs and fixtures. Types and uses.
4.	Make operation sequence for different operations (milling , drilling ,shaping, slotting) Machining of internal spline and external spline on slotter.	Interchangeability – Limit, Fit, Tolerances and allowances. Introduction and their indexing process on a slotter by its rotary table graduations. Form tool for slotting machines. Calculation for spur gear in relation to graduation of circular table.
5	Boring a cast block on a vertical milling machine, measurement of bore size. Demonstration of marking system of Grinding wheels. Surface grinding practices.	Vertical milling machines its parts, construction, method of boring in a vertical milling. Difference between horizontal and vertical milling machine. Elements of milling cutter Rake angle, primary, secondary and clearance angles, lead etc. Selection procedure of grinding wheels.

		Abrasives its types Bonds, Grade Grit, structure, different shape of wheels and their uses. Inside micrometer, Principle, construction graduation reading both in English and metric system gauge types and uses.
6	Demo of parts of CNC machining center – control switches, console buttons and machines specifications (spindle power, axes traverse, etc.) Demonstration of machine parts - bed, spindle motor and drive, tool changer, axes motors and ball screws, guide ways, LM guides, console, electrical, coolant system, hydraulic system, chip conveyor. Working of parts explained using multimedia CNC simulator. Parts shown on machine. CNC part programming with simple exercises and various programming codes. Practice on CNC machine simulator.	CNC technology basics: Difference between CNC and conventional lathes. Advantages and disadvantages of CNC machines over conventional machines. Schematic diagram of CNC system. Axes convention. Working of parts explained using multimedia CNC teachware. Parts shown on machine. Programming – XY coordinate, G code & M code, sequence, formats, different codes, canned cycles. Absolute and incremental programming. Tool nose radius compensation (G41/42). Cutting tool materials, cutting tool geometry – insert types, holder types, insert cutting edge geometry. Cutting parameters - cutting speed, feed rate and depth of cut. Process planning, tool selection and cutting parameters selection. Explained using multimedia CNC teachware and CNC machine simulator. Circular interpolation, Macro programming, CNC parameter setting,
7.	CNC TURNING Operating the CNC machine in different modes such as JOG, MPG, MDI/MDA. Procedure for reaching reference point. Practice on Work & Tool offset measurement. Program loading and machine setting. Executing the program in	CNC TURNING Modes of operation such as JOG, MPG, REF, MDI/MDA. Program execution in different modes like auto SBL and auto cont. mode. Knowledge on CNC cutting tools-Geometry, material, cutting speed, feed, and depth of cut. Techniques of tool off-setting and tool setting. Prepare various programs as per drawing.

	auto SBL and auto cont. mode. Practice on CNC machine simulator.	
8.	CNC machining center operation in various modes: jog, single block, auto, MDI, edit, etc. Program entry. Setting of tool offsets, entry of tool radius. Practice on CNC machine simulator. Program and cut parts on CNC machining center with face milling, contour milling with tool radius compensation, pocket milling, drilling, peck drilling, countersinking, tapping operations using canned cycles for hole operations. First 80 % of the practice is on CNC machine simulator, followed by 20 % on machine.	Program execution in different modes like single block, manual and auto. Tool and work offsets setting. Prepare various programs as per drawing. Concepts taught using multimedia CNC teachware. Interpretation of Alram – Messages , Recovery procedure. Surface finish. Surface roughness related BIS symbols
9.	Prepare different types of documentation as per industrial need by different methods of recording information. Familiarization with inspection and master gauge checking of finished product with limit gauges for their accuracy and usability. Use of Sine Bar, snip gauges along with standard balls and rollers for measurement of taper. Measuring with tool maker's microscope. Testing of gears for its measurements and accuracy. Use of profile projector.	Importance of Technical English terms used in industry –(in simple definition only)Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards. Definition, description and use of worker's inspection and master gauge. Principle, construction and use of sine bar and sine center. Types and description of slip gauges, purpose, construction and method to use tool makers. Microscope and profile projector.

10.	Milling gears by differential indexing, Measuring the teeth with a vernier gear tooth caliper.	Spiral introduction, type and elements. Difference between helix & spiral. Difference between R.H. and L.H. helix. Spiral-lead, helix angle and calculation. Cam: Introduction development and use. Use of proper cutting speed and feed for various metals. Calculation for the machining time, machining allowances. Lubricant/coolants and various ways of their application. Cam-lobe, lead setting of dividing head, Calculation. Vernier gear tooth caliper, its construction and application in checking gear tooth.
11.	Milling spline (external) Milling straight fluted Reamer. Milling a helical groove in a vertical milling machine.	Introduction to broaching methods of milling splines. Its calculations and selection of cutters. Spiral milling lead, pitch, helix angle R.H. and L.H. swiveling the table in relation to the helix angle, selection of cutter for spiral milling. Calculations for spiral milling. Cam-types, application in modern m/c. tools, its special advantages, manufacturing process, calculation for milling a drum cam. Helical gear introduction elements and calculation. Introduction geometry and uses of bevel gears. Quality control types of variation, causes of variation, measurement of testing, gear & error.
12.	Practice on routine maintenance, Periodic checking for lubrication, Hydraulic oil level, Hydraulic system pressure, chuck Pressure	Introduction to rack, its use & application. Rack cutting attachment, calculation for linear pitch, circular pitch, Gear ratio, Indexing

	adjustment for different material. Cleaning & adjusting the Pneumatic Filter, Pressure regulator & Lubricator.	movement, etc. Introduction, geometry and use of worm and worm wheel. Preventive Maintenance, Predictive Maintenance & Concepts of TPM (Total Production Management), TQM (Total Quality Management). Difference between breakdown and preventive maintenance – Its importance in productivity, types. Normal procedure followed for maintenance of machine tool in the shop floor.
13	**Revision & Internal Assessment**	

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

9. SYLLABUS - CORE SKILLS

9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

Block – I		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration: - 30 hrs.)**
1.	**Units & Measurements-** FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units Conversion of units and applied problems.	**Engineering Drawing:** Introduction and its importance Different types of standards used in engineering drawing. 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.
2.	**Material Science** : properties -Physical & Mechanical, Types -Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals	Lines : types and applications in Drawing as per BIS SP:46-2003 Drawing geometrical object using all types of lines. **Drawing of Geometrical Figures:** Angle, Triangle, Square, Rectangle and Circle. **Letters: -** Lettering styles, Single stroke letters and numbers as per IS standard. Lettering practice.
3.	**Mass .Weight and Density** : Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,	**Dimensioning**- Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions. **Scales**:-Types use and construction. Representative factor of scale.
4.	**Speed and Velocity:** Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation. Average Velocity, Acceleration & Retardation. Related problems. Circular Motion: Relation between circular motion and Linear motion,	Method of presentation of Engineering Drawing - Pictorial View - Orthogonal View - Isometric view Circle and its elements.

	Centrifugal force, Centripetal force	
5.	**Ratio & Proportion** : Simple calculation on related problems. **Percentage:** Introduction, Simple calculation.	- **Constructions: -** Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand
6.	**Work, Power and Energy:** work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy. Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.	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. - Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks

Block – II		
Sl. No.	**Workshop Calculation and Science (Duration: - 20 hrs.)**	**Engineering Drawing (Duration : - 30 hrs.)**
1.	**Algebra:** Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	**Screw :-** Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread.
2.	**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.	**Rivets and Joints:-** Prepare a drawing sheet on rivets nomenclature and Joints.
3.	**Mensuration:** Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere. Surface area of solids -cube, cuboid, cylinder and Sphere. Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks.	**Free hand Sketches for simple pipe line with general fittings.**
4.	**Basic Electricity:** Introduction, use of electricity, how electricity is produced, 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 earthling.	**Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.**
5.	**Simple machines Transmission of power:** - Transmission of power by belt, pulleys & gear drive. **Heat treatment process: -** Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering.	**Simple exercises related to trade related symbols.** **Basic electrical and electronic symbols**
6.	**Trigonometry:** Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical	**Free hand sketch of trade related components / parts /cutting tool indicating angles.**

	method. Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem.	
7.	**Concept of pressure** - **Definition**:-Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems	
8.	**Simple exercises related to trade related Test Papers. 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-JOBTRAINING)

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR OPERATOR ADVANCE MACHINE TOOLTRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Making components observing different metal removing procedure and perform different fitting job.
4. Assembling of different components as per requirement and check functionality.
5. 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: -

A. BLOCK – I (09 months)

1. Safety and best practices/Basic Industrial Culture (5S, KAIZEN, etc.) emphasizing more on housekeeping.
2. Prepare different types of documentation as per industrial need by different methods of recording information.
3. Perform marking out the components for filing, drilling, and allied operations.
4. Blueprint reading of technical documents - part, assembly drawings
5. Produce finished components by performing different shaping & slotting operations and check for Quality check for finish result.
6. Produce finished components by performing different planing operation and check for accuracy. (Optional)
7. Produce finished components by performing different lathe & milling operations and check for accuracy.
8. Perform preventive maintenance of lathe, shaping, slotting, planning, milling and grinding machines.
9. Set and operate surface grinder to produce components and check the job accuracy.
10. Set and operate cylindrical grinder to produce components and check the job accuracy.
11. Produce different components using non conventional machine.

B. BLOCK – II (09 months)

12. Produce different forms of threads viz., “V”, Square and Acme thread applying basic methods, machine tools, materials and information.

13. Work out and apply cutting parameters for different turning, drilling& milling operations with different work and tool material for producing quality output.
14. Grind Form tool and parallel & stepped using grinding machine with accuracy using appropriate tools & materials and with required quality.
15. Manufacture different components viz., V-block, Key-way, concave & convex surface, horizontal, angular, vertical, male-female T-slot & dovetail, multiple jobs at a time by determining use of shaping /and slotting /and planning machine.
16. Produce different components by performing different operation viz., step milling, straddle milling, square & hexagonal milling, T-slot & dovetail milling using milling machine with clear choice of procedures.
17. Demonstrate practical skills to ream the drilled hole using radial drill machine.
18. Make different components viz., spur gear, helical, Bevel, worm & worm wheel, rack & pinion by setting the milling machine.
19. Produce different components viz., end mill/drum cam, face cam, plate cam using milling machine and by applying quality concept.
20. Manufacture different components viz., spline (external), straight fluted reamer, cylindrical cutter, slab milling cutter, twist drill using milling machine with clear choice of procedures.
21. Process planning - machining sequence, cutting tools selection, cutting parameters, work holding devices.
22. CAD/CAM software operation, DNC operation. Co ordinate measurement, care & upkeep of machine.
23. CNC part programming, operations and machine settings, verification (simulation of CNC part programs and machine simulation) and Preventive maintenance of CNC machines.
24. Set and operate CNC Vertical Machining Centre (3 – axes) to produce components by preparing part programmes & applying range of cognitive and practical skills.
25. Set and operate CNC lathe machine to produce components by preparing part programmes and carry out basic preventive maintenance of CNC machines.
26. Perform TPM (Total Productive Maintenance), TQM (Total Quality Management) and record keeping system.

Note:

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

ANNEXURE – I

INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE

OPERATOR ADVANCE MACHINE TOOL			
LIST OF TOOLS AND EQUIPMENT for Basic Training (For 16 Apprentices)			
A. TRAINEES TOOL KIT			
Sl. no.	**Name of the Tool &Equipments**	**Specification**	**Quantity**
1	Screw drivers	150 mm	16 nos.
2	Screw driver star		2 set
3	Long nose plier	150mm.	16 nos.
4	Combination plier	150mm.	16 nos.
5	Diagonal cutter	150mm.	16 nos.
6	Adjustable spanner or side wrench		16 nos.
7	Hack saw frame adjustable with blades	250 - 300mm.	16 nos.
8	Flat file	200mm.	16 nos.
9	File triangular	150 mm.	16 nos.
10	Half round file	150 mm	11 nos
11	Square file	150 mm	11 nos.
12	Ring spanner set		2 sets
13	Box spanner set		2 sets
14	Hammer cross pane With handle	750 gms.	11 nos.
15	Hammer small With handle	250gms.	11 nos.
16	Neon tester		2 nos.
17	Grease Gun		1 nos.
18	Bearing Extractor		1 no.
B : INSTRUMENTS & GENERAL SHOP OUTFIT			

19.	Steel rule Graduated both in English and Metric unit.	30 cm.	11 nos.
20.	Outside spring caliper	150mm.	11 nos.
21.	Inside spring caliper	150mm.	11 nos.
22.	Hermaphrodite caliper	150mm.	6 nos.
23.	Divider spring	150mm.	6 nos.
24.	Center punch	100mm.	11 nos.
25.	Prick punch	100mm.	11 nos.
26.	Scraper A (bearing).	250mm.	11 nos.
27.	Scraper B (triangular).	250mm.	11 nos.
28.	ScraperC(half round).	250mm.	11 nos.
29.	Scriber. (one side offset).	150x3 mm	11 nos.
30.	Cold chisel	20x 200mm.	11 nos.
31.	Cross chisel	10x 150mm	11 nos.
32.	Diamond point chisels	10x 150mm.	11 nos..
33.	Safety glasses.		21 nos.
34.	Flat 2nd.Cut	250mm.	11 nos.
35.	Chisel flat	25x 200mm.	11 nos.
36.	Surface plate. With stand	400mm.X 400mm. Grade 1	2 nos.
37.	Marking off table	1200x 1200x 900mm.	1 no.
38.	Scribing block universal	300mm.	1 no.
39.	Vee block	100/7-80-A	11 nos.
40.	Try square	300mm.	11 nos.
41.	Out side spring caliper	200mm.	11 nos.
42.	Divider spring	200mm.	11 nos.
43.	Inside spring caliper	200mm.	11 nos.
44.	Straight edge steel1 meter		2 nos.
45.	Straight edge steel	500mm.	2 nos.
46.	Steel tape in case	2 meter	1 no.
47.	Sprit level	2V 250, 05 meter	2 nos.
48.	Combination set	300mm.	3 nos.
49.	Hexagonal allen keys	2.5 to 12mm.	11 sets
50.	Spanner D.E. assorted	6mm to 32mm	6 sets
51.	Adjustable spanner.	300mm	6 nos.
52.	Reduction sleeve Morse	1-2, 2-3, 3-4, 2-4	5 sets
53.	Angle plate adjustable	250x 150x 175mm.	5 nos
54.	Solid parallels in pairs (different		13 nos.

	sizes)metric		
55.	Oil can pressure feed	500mg.	6 nos.
56.	Oil stone	150x 50x 25mm.	3 sets
57.	Number drills HSS (parallel shank)		3 sets
58.	Drill (parallel)		3 sets
59.	Twist drills (parallel shank)	3mm. To 13mm.	3 sets
60.	Drill chuck with taper shank	0-12mm	3 sets
61.	Centre drill A	1 to 5	2 nos.
62.	Grinding wheel dresser (diamond)		2 nos.
63.	Grinding wheel dresser (hunting tone type)		12 nos.
64.	Clamp C	100mm.	12 nos.
65.	Clamp C	200mm.	5 nos
66.	Tap and die set in box metric pitch		3 sets
67.	Drill HSS taper shank		12 nos.
68.	Needle file set		5 set.
69.	Reamer	6mm. to 25mm. by 1mm.	2 set
70.	Reamer adjustable	10mm. to 15mm. by 75mm.	2 set
71.	Tool bits HSS square	6mm.	1 doz.
72.	Tool bits HSS square	10mm.	1 doz.
73.	Tool bits holder (Armstrong) LH		12 nos.
74.	Tool bits holder (Amstrong) RH		12 nos.
75.	Assorted tools for lathe, shaper, slotter & planner of different shapes &sizes.		8 nos. each
76.	Table chuck jaw swivel base	75mm.	2 nos.
77.	Machine vice swivel base	200mm.	4 nos.
78.	Machine vice swivel base	160mm.	2 nos.
79.	Hand vice jaw	50mm.	6 nos.
80.	Compound angle vice (standard sine)		3 nos.
81.	Universal sine		3 nos.
82.	Universal table angle plate		3 nos.
83.	Shaper tool holder turret type		3 nos.
84.	Shaper indexing center		1 no.
85.	Knurling tools (set of 3) straight and diamond		1 each for 12 trainees
86.	Plier cutting.	200mm	2 nos.
87.	Magnifying glass	75mm.	2 nos.
88.	Carbide tipped tools of different sizes		3 sets

	&shapes (throw away tips)		
Milling Cutter			
89.	Cylindrical cutter (different sizes and as per the arbor of the machine)		20 nos.
90.	Side and face cutter (different sizes and as per the arbor of the machine)		20 nos.
91.	Equal angle cutter (different sizes and as per the arbor of the machine)		20 nos.
92.	Double angle unequal cutter (different sizes and as per the arbor of the machine)		20 nos.
93.	Single angle cutter LH & RH (different sizes and as per the arbor of the machine)		20 nos.
94.	End mill cutter -	Dia. 6 mm - 20 mm (in steps of 2 mm)	2 sets.
95.	Shell end mill cutter	Dia. 32 mm & 50 mm each 2 nos.	2 sets
96.	Slitting saw	different sizes and as per the arbor of the machine	10 nos.
97.	Slot drill (key seating)	4 mm to 12 mm in steps of 2 mm	3 sets.
98.	T-slot cutter to suit T-headed bolt	of 10, 12mm. straight shank	6 nos.
99.	T-slot cutter to suit T-headed bolt	of 12, 18, 22mm. taper shank	6 nos.
100.	Milling cutters (involute) DP-	8, 10, 12, 16& 20, No.1 to8	12 nos.
101.	Milling cutters (involute)	1, 2, 2.5,3&4	12 nos.
102.	Convex milling cutter	2.5mm, 4mm, 10mm.,20mm	12 nos.
103.	Concave milling cutter	R-2.5mm, 4mm, and 10mm.	12 nos.
104.	Milling cutter	R-2.5mm, 4mm, 10mm, and 16mm.	12 nos.
105.	Milling cutter face mill inserted type	100x 27 bore	12 nos.
106.	Milling cutter face mill inserted type	150x 32 bore	12 nos.
Measuring Instrument			
107.	Micrometer Outside	0-25mm.	6 nos. each

108.	Micrometer Outside	25-50mm.	
109.	Micrometer Outside	50-75mm.	
110.	Micrometer depth gauge	0-200mm.	
111.	Direct reading vernier caliper B	300 (direct reading with dial)	
112.	Vernier height gauge.	250mm	
113.	Vernier gear tooth caliper		2nos.
114.	Vernier bevel protractor with blade	150mm.	2 nos.
115.	Bevel gauge	200mm	2 nos.
116.	Telescopic gauge	13 mm. to 300mm.	2 nos.
117.	Sine Bar	200mm.	3 set
118.	Dial test indicator with magnetic gauge type1gradeA with magnetic base		2 nos
119.	Centre gauge	60^0	2 nos.
120.	Slip gauge set (normal set)		6 nos.
121.	Screw pitch gauge for metric pitches		1 set
122.	Radius gauge metric set		2 set
123	Limit plug gauges	5mm. to 25mm.	2 set
124	Ring gauges	5mm to 25mm. by 2.5mm (Go& No Go)	2 set
125	Taper gauge	M.T. No. 1, 2, 3,4&5	2 set
126	Feeler gauge		2 set
127	Planer gauge standard size		2 set
General Furniture			
128	Steel lockers for 20 trainees		1 no.
129	Steel chair for instructor		2 nos.
130	Steel table for instructor		1 no.
131	Work bench for fitters with four vices of 100mm. jaw		5 nos.
132	Steel cupboard.	180x 90x 45cm	12 nos.
133	Steel cupboard	120x 60x 45cm.	12 nos.
134	Black board with easel		1 no.
135	Computer table and chair		10 sets

136	FirstAid Box		1 no.
C : GENERAL MACHINERY INSTALLATIONS			
137	Lathe S.S & S.C.(all geared type) with minimum specification as:.		3 nos.
138	Drilling machine pillar type capacity with drill chuck & key.	20mm.	1 no.
139	Universal Milling machine with minimum specification as:	Table Length x width 1200 x 300 mm having motorized up & down movement along with auto feed arrangement and with following attachments such as: a. Vertical head b. Slotting attachment c. Rack cutting attachment d. Rotary table e. Dividing head Adaptors, arbors and collects etc. for holding straight shank drills and cutters from 3 mm to 25 mm.	1 no.
140	Vertical Milling Machine with minimum specification as:	Table Length x width 1200 x 300 mm having motorized up & down movement along with auto feed arrangement along with 150mm universal vice.	2 nos.
141	Surface grinding machine wheels	dia.180mm. Reciprocating table, longitudinal table traverse 200mm fitted with adjustable traverse stop. Full motorizedsuppliedwithmagneticchuck250mm.x 120mm. diamond tool holder, set of spanner, grease etc.	1 no.
142	Cylindrical grinding machine with internal grinding attachments with minimum specification as:	To accommodate 750mm job with centre height 150mm. Wheel diameter x	1 no

		width = 300 x 25mm.	
143	CNC lathe/CNC turn Centre with minimum specification as: .	Chuck size:135mm Between centre distance: 250mm Travel in X: 100mm Travel in Z: 200mm No. of tool stations: 8 station turret Spindle power: 3.7kW (continuous rating) preferably with popular control system like Fanuc/Siemens or equivalent along with motorized coolant system	2 no
144	CNC Milling Machine/Vertical Machining Centre with minimum specification as:	Table size:500x250mm Travel X-axis x Y-axis x Z-axis: 300 x 250 x 250mm Auto Tool Changer: 8 nos. Spindle power: 3.7kW (continuous rating) with popular control system like Fanuc/Siemens or equivalent along with motorized coolant system.	2 nos.
145	a) Multimedia based simulator for CNC technology and interactive CNC part programming software for turning & milling with virtual machine operation and simulation using popular operation control system such as Fanuc, Siemens, etc. (Web-based or licensed based) (10 trainess + 1 faculty)		11 user
146	Desktop with MS-Windows-7 or latest to run above software, networked on LAN.		10 nos.
147	LCD projector		1 no

INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING DRAWING

TRADE: OPERATOR ADVANCE MACHINE TOOL

LIST OF TOOLS& EQUIPMENTS FOR -16 APPRENTICES

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

2) Infrastructure:

A : TRAINEES TOOL KIT:-			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1.	Draughtsman drawing instrument box		16+1 set
2.	Set square celluloid 45^o (250 X 1.5 mm)		16+1 set
3.	Set square celluloid 30^o-60^o (250 X 1.5 mm)		16+1 set
4.	Mini drafter		16+1 set
5.	Drawing board (700mm x500 mm) IS: 1444		16+1 set
B : Furniture Required			
Sl. No.	**Name of the items**	**Specification**	**Quantity**
1	Drawing Board		16
2	Models : Solid & cut section		as required
3	Drawing Table for trainees		as required
4	Stool for trainees		as required
5	Cupboard (big)		01
6	White Board (size: 8ft. x 4ft.)		01
7	Trainer's Table		01
8	Trainer's Chair		01

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

ANNEXURE-II

FORMAT FOR INTERNAL ASSESSMENT

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

Sl. No	**Maximum Marks (Total 100 Marks)**		15	5	10	5	10	10	5	10	15	15		
	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)**
1														
2														