



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

**COMPETENCY BASED CURRICULUM**

# **OPERATOR ADVANCE MACHINE TOOL**

(Duration: Two Years)

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL- 5**



**SECTOR – PRODUCTION & MANUFACTURING**

# **OPERATOR ADVANCE MACHINE TOOL**

**(Engineering Trade)**

**(Revised in 2018)**

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL - 5**

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

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## 1. COURSE INFORMATION

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During the two years duration, a candidate is trained on subjects- Professional Skill, Professional Knowledge, Engineering Drawing, Workshop Science & Calculation and Employability Skills. In addition to this, a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously theory subject is taught in the same fashion to apply cognitive knowledge while executing task.

The content broadly covers manufacturing different components by operating different conventional and CNC machines. The broad components covered under Professional Skill subject are as below:

**1<sup>st</sup> Semester**– In this semester, the contents covered are from safety aspect related to the trade, basic fitting operations viz., making, filing, sawing, chiseling, drilling, tapping, grinding and sheet metal work. The practical also involves producing components by different turning and milling operations along with basic maintenance of machines.

**2<sup>nd</sup> Semester**– The practical training, it starts with operation of grinding machine and broad information on different special machines is provided. Followed by different advanced turning and milling machines operation with extensive coverage of different operations & manufacturing components viz., taper turning, eccentric turning, boring, screw thread, multi start thread, gang milling, splines & different gears. Further inspections of components using different instruments & gauges and testing geometrical accuracy of machines are conducted.

**3<sup>rd</sup> Semester**– In this semester, all aspect of CNC turning covered starting from machine operations, programming and producing components on actual machine.

**4<sup>th</sup> Semester**– During this semester, the CNC milling operation is covered in all aspect of CNC milling covered starting from machine operations, programming and producing components on actual machine. Finally, different basic maintenance of machines are carried out so that trainees get acquainted with a different machine maintenance required in day to day operation.

## 2. TRAINING SYSTEM

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### 2.1 GENERAL

The Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers a range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under the 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 CTS is one of the popular courses delivered nationwide through a network of ITIs. The course is of two years (04 semester) 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 science, Engineering Drawing and Employability Skills) impart requisite core skill & knowledge and life skills. After passing out of the training programme, the trainee is awarded National Trade Certificate (NTC) by NCVT which is recognized worldwide.

#### **Candidates broadly need to demonstrate that they are able to:**

- Read & interpret technical parameters/documentation, 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 knowledge, core skills & employability skills while performing the job and machining work.
- Check the job/components as per drawing for functioning, identify and rectify errors in job/components.
- Document the technical parameters related to the task undertaken.

### 2.2 CAREER PROGRESSION PATHWAYS:

- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.



## 2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (04 semesters):

S No.	Course Element	Notional Training Hours
1	Professional Skill (Trade Practical)	2185
2	Professional Knowledge (Trade Theory)	510
3	Workshop Calculation & Science	170
4	Engineering Drawing	255
5	Employability Skills	110
6	Library & Extracurricular Activities	170
7	Project Work	240
8	Revision & Examination	520
	<b>Total</b>	<b>4160</b>

## 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 the 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 NTC will be conducted by NCVT at the end of each semester as per the guideline of Govt. of India. The pattern and marking structure is being notified by Govt. of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check** individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

## 2.4.1 PASS REGULATION

The minimum pass percentage for Practical is 60% & minimum pass percentage for Theory subjects is 40%. For the purposes of determining the overall result, 25% weightage is applied to the result of each semester examination.

## 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 teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/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 should produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices.	<ul style="list-style-type: none"> <li>• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment.</li> <li>• Below 70% tolerance dimension achieved while undertaking different work with those demanded by the component/job.</li> <li>• A fairly good level of neatness and consistency in the finish.</li> <li>• Occasional support in completing the project/job.</li> </ul>
(b) Weightage in the range of 75%-90% to be allotted during assessment	

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<p>For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices.</p>	<ul style="list-style-type: none"> <li>• Good skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• 70-80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.</li> <li>• A good level of neatness and consistency in the finish.</li> <li>• Little support in completing the project/job.</li> </ul>
<p>(c) Weightage in the range of above 90% to be allotted during assessment</p>	
<p>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.</p>	<ul style="list-style-type: none"> <li>• High skill levels in the use of hand tools, machine tools and workshop equipment.</li> <li>• Above 80% tolerance dimension achieved while undertaking different work with those demanded by the component/job.</li> <li>• A high level of neatness and consistency in the finish.</li> <li>• Minimal or no support in completing the project.</li> </ul>

### **3. JOB ROLE**

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Brief description of job roles:

The advanced machine operator performs 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). 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. Does process planning, tool and cutting parameters selection, programming, setup and operation for cutting parts on CNC vertical machining center and CNC lathe.

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

May be designated as **Operator Advance Machine Tool** according to nature of work done

**Reference NCO-2015:**

- i) 7223.0500
- ii) 7224.0100

## 4. GENERAL INFORMATION

<b>Name of the Trade</b>	OPERATOR ADVANCE MACHINE TOOL
<b>NCO - 2015</b>	7223.0500, 7224.0100
<b>NSQF Level</b>	Level – 5
<b>Duration of Craftsmen Training</b>	Two years (Four semesters each of six months duration)
<b>Entry Qualification</b>	Passed 10 <sup>th</sup> Class with Science and Mathematics under 10+2 system of education or its equivalent
<b>Unit Strength (No. Of Students)</b>	12 (Max. supernumeraries seats: 4)
<b>Space Norms</b>	144 Sq. m
<b>Power Norms</b>	25 KW
<b>Instructors Qualification for</b>	
<b>1. Operator Advance Machine Tool Trade</b>	<p>Degree in Mechanical/ Production Engineering from recognized Engineering College/university with one year experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma in Mechanical/Production Engineering from a recognised Board of Technical Education with two years' post qualification experience in the relevant field.</p> <p style="text-align: center;"><b>OR</b></p> <p>NTC/NAC passed in the Trade of “Operator Advance Machine Tool” With 3 years' post qualification experience in the relevant field.</p> <p><b><u>Desirable:</u></b> Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Operator Advance Machine Tool/ Machinist trade.</p> <p><b><u>Note:</u></b> <i>Out of two Instructors required for the unit of 2 (1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.</i></p>
<b>2. Workshop Calculation &amp; Science</b>	<p>Degree in Engineering with one year experience.</p> <p style="text-align: center;"><b>OR</b></p> <p>Diploma in Engineering with two-year experience.</p> <p><b><u>Desirable:</u></b> Craft Instructor Certificate in RoD&amp;A course under NCVT.</p>
<b>3. Engineering Drawing</b>	<p>Degree in Engineering with one year experience.</p> <p style="text-align: center;"><b>OR</b></p>

	<p>Diploma in Engineering with two-year experience.  <b>OR</b>          NTC/ NAC in the Draughtsman (Mechanical) with three-year experience.  <b>Desirable:</b>          Craft Instructor Certificate in RoD&amp;A course under NCVT.</p>					
<b>4. Employability Skill</b>	<p>MBA OR BBA with two-year experience OR Graduate in Sociology/ Social Welfare/ Economics with two-year experience OR Graduate/ Diploma with two-year experience and trained in Employability Skills from DGT institutes.  <b>AND</b>          Must have studied English/ Communication Skills and Basic Computer at 12th/ Diploma level and above.  <b>OR</b>  <b>Existing Social Studies Instructors duly trained in Employability Skills from DGT institutes.</b></p>					
<b>List of Tools and Equipment</b>	As per Annexure – I					
<b>Distribution of training on Hourly basis: (Indicative only)</b>						
<b>Total Hours/Week</b>	<b>Trade Practical</b>	<b>Trade Theory</b>	<b>Work shop Cal. &amp;Sc.</b>	<b>Engg. Drawing</b>	<b>Employability Skills</b>	<b>Extra-curricular Activity</b>
40 Hours	25 Hours	6 Hours	2 Hours	3 Hours	2 Hours	2 Hours

## 5. NSQF LEVEL COMPLIANCE

NSQF level for **Operator Advance Machine Tool** trade under CTS: **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 CTS 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
<b>Level 5</b>	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.

## **6. LEARNING/ ASSESSABLE OUTCOME**

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*Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.*

### **6.1. GENERIC LEARNING OUTCOME**

1. Recognize & comply with 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**

#### **Semester – I**

9. Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy. [Basic fitting operation – marking, Hack sawing, Chiselling, Filing, Drilling, Taping and Grinding etc. Accuracy:  $\pm 0.25\text{mm}$ ]



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10. Plan & perform simple repair, maintenance of different machines and check for functionality. [*Different Machines – Drill Machine, Power Saw and Bench Grinder*]
11. Prepare different cutting tool to produce jobs to appropriate accuracy by performing different turning operations. [*Different cutting tool – V tool, side cutting, parting, thread cutting (both LH & RH), Appropriate accuracy: -  $\pm 0.06\text{mm}$ , Different turning operation – Plain, facing, drilling, boring (counter & stepped), grooving, Parallel Turning, Step Turning, parting, chamfering, U -cut, Reaming, knurling.*]
12. Set the different machining parameters and cutters to prepare job by performing different milling operation and indexing. [Different machining parameters – feed, speed and depth of cut. Different milling operations – plain, face, angular, form, gang, straddle milling]

### **Semester – II**

13. Produce components of high accuracy by different operations using grinding. [*Different operations – surface grinding, cylindrical grinding with an accuracy of  $\pm 0.01\text{ mm}$* ]
14. Set different components of machine & parameters to produce taper/ angular components and ensure proper assembly of the components. [*Different component of machine: Form tool, Compound slide, tail stock offset; Different machine parameters- Feed, speed, depth of cut.*]
15. Set the different machining parameters to produce screw & multi start threaded components applying method/ technique and test for proper assembly of the components
16. Set the different machining parameters and cutters to prepare components by performing different milling operation and indexing. [*Different machining parameters – feed, speed and depth of cut. Different components – Rack, Spur Gear, External Spline, bevel gear, Helical Gear, worm & work wheel.*]
17. Measure components using different instrument/ gauge and test machine tool accuracy. [*Different instrument/ gauges- limit gauges, Sine Bar, snip gauges, tool maker's microscope and profile projector; Simple Machines – Drill Machine, Power Saw and Lathe*]

### **Semester – III**

18. Set (both job and tool) CNC turning centre and produce components as per drawing by preparing part programme.

### **Semester – IV**

19. Set (both job and tool) CNC machining centre and produce components as per drawing by preparing part programme.
20. Plan and perform simple repair and maintenance of different machines and check for functionality. [*Different Machines – Drilling Machine, milling machine and Lathe*]

## 7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

<b>GENERIC LEARNING/ ASSESSABLE OUTCOME</b>	
<b>Learning/ Assessable Outcomes</b>	<b>Assessment Criteria</b>
1. Recognize & comply with 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 of dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.
	1.5 Identify and observe site policies and procedures in regard to illness or accident.
	1.6 Identify safety alarms accurately.
	1.7 Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.
	1.8 Identify and observe site evacuation procedures according to site policy.
	1.9 Identify Personal Productive Equipment (PPE) and use the same as per related working environment.
	1.10 Identify basic first aid and use them under different circumstances.
	1.11 Identify different fire extinguisher and use the same as per requirement.
	1.12 Identify environmental pollution & contribute to avoidance of same.
	1.13 Take opportunities to use energy and materials in an environmentally friendly manner.
	1.14 Avoid waste and dispose waste as per procedure.
	1.15 Recognize different components of 5S and apply the same in the working environment.
2. Understand, explain different mathematical calculation & science in the field of study including basic electrical and	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.

<p>apply in day-to-day work. [Different mathematical calculation &amp; science -Work, Power &amp; Energy, Algebra, Geometry &amp; Mensuration, Trigonometry, Heat &amp; Temperature, Levers &amp; Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]</p>	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.
<p>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 &amp; different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical &amp; electronic symbol]</p>	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.
<p>4. Select and ascertain measuring instrument and measure dimension of components and record data.</p>	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 with the given drawing/measurement.
<p>5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day-to-day work to improve productivity &amp; quality.</p>	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, 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 resources 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 familiarize 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.

<b>SPECIFIC LEARNING/ ASSESSABLE OUTCOME</b>	
<b>SEMESTER-I</b>	
<b>Learning/ Assessable Outcomes</b>	<b>Assessment Criteria</b>
9. Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy. [Basic fitting operation – marking, Hack sawing, Chiselling, Filing, Drilling, Taping and Grinding etc. Accuracy: $\pm 0.25\text{mm}$ ]	9.1 Plan & identify tools, instruments and equipments for marking and make this available for use in a timely manner.
	9.2 Select raw material and visual inspection for defects.
	9.3 Mark as per specification applying desired mathematical calculation and observing standard procedure.
	9.4 Measure all dimensions in accordance with standard specifications and tolerances.
	9.5 Identify hand tools for different fitting operations and make these available for use in a timely manner.
	9.6 Prepare the job for Hacksawing, chiselling, filing, drilling, tapping, grinding.
	9.7 Perform basic fitting operations viz., Hacksawing, filing, drilling, tapping and grinding to close tolerance as per specification to make the job.
	9.8 Observe safety procedure during above operation as per standard norms and company guidelines.
	9.9 Check for dimensional accuracy as per standard procedure.
	9.10 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
10. Plan & perform simple repair, maintenance of different machines and check for functionality. [ <i>Different Machines – Drill Machine, Power Saw and Bench Grinder</i> ]	10.1 Ascertain and select tools and materials for the repair, maintenance and make this available for use in a timely manner.
	10.2 Plan work in compliance with standard safety norms.
	10.3 Demonstrate possible solutions and agree tasks within the team.
	10.4 Select specific parts to be repaired and ascertain for appropriate material and estimated time.
	10.5 Repair and assemble the parts in the machine with the help of blue print.
	10.6 Check for functionality of part and ascertain faults of the part/ machine in case of improper function.
	10.7 Rectify faults of assembly.
11. Prepare different cutting tool to produce jobs to appropriate accuracy by	11.1 Identify cutting tool materials used on lathe machine as per the specification and their application.
	11.2 Plan and grind cutting tools.

<p>performing different turning operations. [<i>Different cutting tool – V tool, side cutting, parting, thread cutting (both LH &amp; RH), Appropriate accuracy: - <math>\pm 0.06\text{mm}</math>, Different turning operation – Plain, facing, drilling, boring (counter &amp; stepped), grooving, Parallel Turning, Step Turning, parting, chamfering, U -cut, Reaming, knurling.</i>]</p>	11.3 Measure the tool angles with gauge and Bevel protractor as per tool signature.
	11.4 Mount the job and set machine parameter.
	11.5 Perform turning operations viz., <i>facing, Parallel Turning, Step Turning, chamfering, grooving, U-cut, parting, drilling, boring (counter &amp; stepped), Reaming, internal recess and knurling to make component as per specification.</i>
	11.6 Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
	11.7 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
<p>12. Set the different machining parameters and cutters to prepare job by performing different milling operation and indexing. [Different machining parameters – feed, speed and depth of cut. Different milling operations – plain, face, angular, form, gang, straddle milling]</p>	12.1 Identify different work and tool holding devices and acquaint with functional application of each device.
	12.2 Mount the work and tool holding devices with required alignment and check for its functional usage to perform milling operations.
	12.3 Observe safety procedure during mounting as per standard norms.
	12.4 Solve problem by applying desired mathematical skill, basic methods, tools, materials and collect and organize information during setting.
<b>SEMESTER – II</b>	
<p>13. Produce components of high accuracy by different operations using grinding. [<i>Different operations – surface grinding, cylindrical grinding with an accuracy of <math>\pm 0.01\text{mm}</math></i>]</p>	13.1 Plan and select appropriate method to produce the work piece as per drawing.
	13.2 Select appropriate tools, equipment and machine to produce the work piece as per drawing and make these available for use in a timely manner.
	13.3 Grind the cutting tool following standard operating practice.
	13.4 Set the job on grinding machine and grind the surfaces as per specification/drawing (parallel and stepped) following standard operating practice.
	13.5 Check the dimension of parallel and stepped job by precession instrument. (micrometer)
	13.6 Observe safety precautions during operation of machine.
	13.7 Check for desired performance
14. Set different components of	14.1 Plan and select appropriate method to produce taper/

<p>machine &amp; parameters to produce taper/ angular components and ensure proper assembly of the components. <i>[Different component of machine: Form tool, Compound slide, tail stock offset; Different machine parameters- Feed, speed, depth of cut.]</i></p>	angular components.
	14.2 Evaluate angles to set up the tool and machine component for machining.
	14.3 Demonstrate possible solutions and agree tasks within the team.
	14.4 Produce taper/ angular components as per standard operating procedure.
	14.5 Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement.
	14.6 Assemble the components to ascertain functionality.
<p>15. Set the different machining parameters to produce screw &amp; multi start threaded components applying method/ technique and test for proper assembly of the components.</p>	15.1 Plan and select appropriate method to produce threaded components.
	15.2 Plan and prepare thread cutting tool in compliance with standard thread parameters.
	15.3 Produce components as per drawing.
	15.4 Check accuracy/ correctness of job using appropriate gauge and measuring instruments for their functional requirement and suit to male/female part.
	15.5 Test the proper assembly of the threaded components.
<p>16. Set the different machining parameters and cutters to prepare components by performing different milling operation and indexing. <i>[Different machining parameters – feed, speed and depth of cut. Different components – Rack, Spur Gear, External Spline, bevel gear, Helical Gear, worm &amp; worm wheel]</i></p>	16.1 Select cutter as per specification of gear and plan to make spur gear, helical, rack & pinion, bevel gear, worm & worm wheel as per drawing.
	16.2 Comply with safety rules when performing the above operations.
	16.3 Work out and apply indexing parameters as per different components to be produced to determine gear setting and set indexing head, milling machine.
	16.4 Demonstrate possible solutions within the team using desired mathematical skills, knowledge of facts, principles, processes and general concept in the field of work to set the indexing head.
	16.5 Solve problems during operation by selecting and applying basic methods, tools, materials and collect and organize information for quality output.
	16.6 Set job and produce component following the standard operating procedure.
	16.7 Make components observing standard operating procedure.
	16.8 Measure with instruments/gauges as per drawing and check functionality of gear.
	16.9 Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.

<p>17. Measure components using different instrument/ gauge and test machine tool accuracy. [<i>Different instrument/ gauges- limit gauges, Sine Bar, snip gauges, tool maker's microscope and profile projector; Simple Machines – Drill Machine, Power Saw and Lathe</i>]</p>	17.1 Ascertain measuring and testing procedure as per manual of machine and select appropriate tools & equipment for undertaking job.
	17.2 Set up workplace/ assembly location with due consideration to operational stipulation
	17.3 Plan to carry out the measuring components and testing of simple machine by collecting necessary information.
	17.4 Demonstrate possible solutions and agree tasks within the team.
	17.5 Put the machine in operation complying Standard operating procedure.
	17.6 Check alignment of machine and other parameters of simple machine as per manual.
<b>SEMESTER – III</b>	
<p>18. Set (both job and tool) CNC turning centre and produce components as per drawing by preparing part programme</p>	18.1 Plan and prepare part programme as per drawing, simulate for its correctness with appropriate software.
	18.2 Prepare tooling layout and select tools as required.
	18.3 Demonstrate possible solution within the team.
	18.4 Set selected tools on to the machine.
	18.5 Test/Dry run the part programme on the machine.
	18.6 Set up the job and machine the component as per standard operating procedure involving parallel, step, taper, drilling, boring, radius, grooving and threading operations, etc.
	18.7 Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
	18.8 Observe safety/ precaution during machining.
	18.9 Avoid wastage, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner and prepare for disposal.
<b>SEMESTER-IV</b>	
<p>19. Set (both job and tool) CNC machining centre and produce components as per drawing by preparing part programme</p>	19.1 Plan and prepare part programme as per drawing applying range of cognitive and practical skills, simulate for its correctness with simulation software.
	19.2 Demonstrate possible solutions within the team.
	19.3 Prepare tooling layout and select tools as required.
	19.4 Set selected tools on to the machine.
	19.5 Test/Dry run the part programme on the machine.
	19.6 Set up the job and produce the component as per standard operating procedure involving face milling, contour milling with tool radius compensation, pocket milling, drilling, peck drilling, countersinking, tapping operations using canned cycle for hole operations.



*Operator Advance Machine Tool*

	19.7 Solve problems during operation by selecting and applying basic methods, tools, materials and information and using quality concept.
	19.8 Check accuracy/ correctness of job using appropriate gauge and measuring instruments.
	19.9 Observe safety/ precaution during machining.
20. Plan and perform simple repair and maintenance of different machines and check for functionality. <i>[Different Machines – Drilling Machine, milling machine and Lathe]</i>	20.1 Ascertain and select tools and materials for the repair and maintenance and make this available for use in a timely manner.
	20.2 Plan work in compliance with standard safety norms.
	20.3 Demonstrate possible solutions and agree tasks within the team.
	20.4 Select specific parts to be repaired and ascertain for appropriate material and estimated time.
	20.5 Repair and carry out maintenance of the machine with the help of blue print.
	20.6 Check for functionality of part and ascertain faults of the part/ machine in case of improper function.

**SYLLABUS- OPERATOR ADVANCE MACHINE TOOL**

**First Semester–06 months**

<b>Week No.</b>	<b>Ref. Learning Outcome</b>	<b>Professional Skills (Trade Practical)</b>	<b>Professional Knowledge (Trade Theory)</b>
1	Recognize & comply with safe working practices, environment regulation and housekeeping.	<p>Importance of trade training, List of tools &amp; Machinery used in the trade. Safety attitude development of the trainee by educating them to use Personal Protective Equipment (PPE).</p> <p>First Aid Method and basic training. Safe disposal of waste materials like cotton waste, metal chips/burrs etc.</p> <p>Hazard identification and avoidance.</p> <p>Identification of safety signs for Danger, Warning, caution &amp; personal safety message.</p> <p>Preventive measures for electrical accidents &amp; steps to be taken in such accidents.</p> <p>Use of fire extinguishers.</p> <p>Practice and understand precautions to be followed while working in fitting jobs.</p> <p>Safe use of tools and equipments used in the trade.</p>	<p>All necessary guidance to be provided to the newcomers to become familiar with the working of Industrial Training Institute system including store's procedures.</p> <p>Soft skills, its importance and job area after completion of training.</p> <p>Importance of safety and general precautions observed in the industry/shop floor.</p> <p>Introduction of first aid. Operation of electrical mains and electrical safety. Introduction of PPEs.</p> <p>Response to emergencies e.g. power failure, fire, and system failure.</p> <p>Importance of housekeeping &amp; good shop floor practices. Introduction to 5S concept &amp; its application.</p> <p>Occupational Safety &amp; Health: Health, Safety and Environment guidelines, legislations &amp; regulations as applicable.</p> <p>Basic understanding on Hot work, confined space work and material handling equipment.</p>
2	Plan and organize the work to make job as per specification applying different types of basic fitting operation and check for dimensional accuracy. [Basic	<p><b>Basic Fitting</b></p> <p>Preparation of filing. Standing posture with respect to bench vice for filing. Marking lines on the job surface for filing to the marked lines. Gripping the job suitably in the vice jaws for filing. Balancing of file, using rough file. Measurement by using inside/ outside calipers and scale.</p>	<p><b>Basic Fitting</b></p> <p>Vice - purpose, types, description, size, construction method to use and maintenance.</p> <p>File - purpose, types, description, size and method to use. Use of file card, printing of file, convexity of file and proper filing technique. Rule - purpose, types, description and method</p>

	fitting operation – marking, Hack sawing, Chiselling, Filing, Drilling, Taping and Grinding etc. Accuracy: ± 0.25mm]		to use.
3-4	-Do-	<p>Use of simple measuring instruments such as steel rule, Vernier caliper, Inside/Outside Micrometer. Care and precaution to be observed in handling these instruments.</p> <p>Exercises on measurement of various geometrical shapes.</p> <p>Exercise on marking out according to simple blue prints, using steel rule, scribe, marking blocks &amp; divider.</p> <p>Scribing lines on chalked or coloured (blue) surfaces of the work piece.</p> <p>Marking location of the position of holes &amp; scribing circles using dividers.</p> <p>Use of Dot and Center Punch for punching the lines, centers and circles.</p> <p>Demo on filing operation, using rough file.</p> <p>Exercise of filing flanges of a channel for balancing of file. Filing flat surface and flange of a channel maintaining parallelism between them using outside caliper within + or - 0.5mm.</p>	<p>Divider - purpose, types, description and method to use.</p> <p>Scriber - purpose, types, description and method to use.</p> <p>Marking Block - purpose, types, description and method to use. Punch - purpose, types, description and method to use.</p> <p>Micrometer - purpose, types, construction, calculation of least count, method to use and read, care and maintenance.</p> <p>Vernier Caliper - purpose, construction, calculation of vernier constant, method to use &amp; read, care and maintenance.</p>
5	-Do-	<p>Exercises on filing to develop control and Field layout the dimensional features of the work piece using vernier height gauge, engineering square, angle plate and surface plate.</p> <p>Exercise on filing the adjoining sides Squareness with respect to one reference surface. Filing faces for maintaining flatness, squareness of adjacent side using try- square, parallelism between opposite sides and reducing thickness. Filing with second cut file to prepare smooth surfaces.</p>	<p>Vernier height gauge - purpose, types, Construction, method to use and read, care and maintenance. Engineer's square - purpose, description and method to use. Surface Plate - purpose, description, method to use, care and maintenance. Angle Plate - purpose, description and method to use.</p>

		Exercise on filing for maintaining dimensions within + or - 0.1mm using vernier caliper.	
6	-Do-	<p>Marking of profiles - combination of straight lines, circles, arcs and angles using scale, divider height gauge, protractor, combination set etc.</p> <p>Marking geometrical profiles on sheet metal and filing to mark lines.</p> <p>Sharpening of marking tools, use of bench grinder for sharpening of scriber, centre punch, dot punch, divider etc. Marking on the job piece for saw cuts. Gripping the job suitably in the vice jaws for hack sawing to dimensions. Hack sawing various metallic pieces (mild steel, aluminum, copper, brass, stainless steel etc.) of different thickness and cross sections, within + or - 0.5mm using hack saw blades of different pitches. Hack sawing different lengths with hack saw frame in horizontal &amp; vertical positions Sawing along the parallel marked lines within 0.5mm allowance for filing. Hack sawing and filing steps and slots and open fitting of finished pieces.</p>	<p>Combination set - purpose, description and method to use. Vernier bevel protractor - purpose, description, calculation of vernier constant, method to read and use, care and maintenance.</p> <p>Bench Grinder - purpose, description, procedure and precautions to be observed during grinding of marking tools, chisels and drill bits. Hack saw - purpose, types, description, method to use and precautions to be taken during hack sawing.</p> <p>Hack saw blade - purpose, types, description, select ON/OFF appropriate grade, fixing of blade and precautions to be observed.</p>
7	-Do-	<p>Hammering practice on vertical hold round job. Blind hammering practice. Stamping letters and numbers on M.S. plates. Exercise on stamping to develop judgment, control on hand and feel.</p> <p>Stamping practice on flat and round surfaces using flat, cross cut and round nose chisels for chipping edges and square to the faces and edges.</p> <p>Checking with Try- square, use of cross peen hammer for stretching of metal strip.</p>	<p>Hammer - purpose, types, description, method to use and precautions to be observed. Bending of solid selections using fixtures. Letters and Numbers - purpose, description, method to use and precautions to be observed. Hollow Punch - purpose, description, method to use for preparations of gaskets and other packing materials. Pipe Fitting - material and types of pipes used in the trade. Method to cut, to thread and preparation of pipes for 'T' fitting elbow fitting, reducers etc. using unions. Method to fill ferrule.</p>
8-9	-Do-	<p>Preparation for drilling, marking out the position of holes and dot punching. Deepening the points with centre</p>	<p>Drills - purpose, types, description, drill holding devices, method to use a drill with or without drill chuck (or collet)</p>

		<p>punch. Checking for centre distance. Drilling practice on sensitive drilling machine using different types of drills and drill holding devices. Safety to be observed while working on drilling machine.</p> <p>Marking, chain drilling and filing to produce square, round and triangular openings on 6mm thick plate. Preparing inserts and fitting in these openings.</p> <p>Drilling practice on varying thickness and different materials such as M.S., C.I., S.S., Cu, Brass, Nylon, Epoxy etc. Drilling on sheet metal, precautions and safety to be observed. Counter Sinking, counter boring, and spot facing operations using bench drilling machine. Exercise on reaming with hand reamers and machine reamers. Internal threading by hand using tap sets. External threading by split die and finishing of thread by die nut. Marking centre of a round bar with the help of 'V' block and clamp. Drilling and reaming of blind holes along the axis of round jobs.</p> <p>Grinding of drills to specifications and checking of angles with gauges.</p> <p>Grinding of chisels.</p>	<p>and precaution to be observed. Reamer -purpose, types, description, method to use, reaming allowance, coolant used and precautions to be observed during reaming. Drilling Machine with manual infeed, its purpose, types, description, drilling fixtures, method to drill and precautions to be observed during drilling. Procedure to be followed for counter sinking, counter boring, spot facing and reaming using bench drilling machine.</p> <p>Screw Threads - elements and forms screw threads single and multi-start thread, right and left hand thread. Taps and Tapping - purpose, types, description, precaution to be observed and method to use hand and machine taps during tapping. Types of coolant to be used. Calculation to drill size for tapping. Method to tap a blind hole, reasons for breakage of tap and method to remove broken tap.</p> <p>Construction and method to use tap wrench. Die and dieing purpose, types, description and method to use and precaution to be observed.</p> <p>Description of die stock, procedure and precautions to be observed during dieing.</p>
10	-Do-	<p>Measurement of shaft and hole diameters using outside and inside micrometer. Filing round out of square bar within <math>\pm 0.1\text{mm}</math>. Filing to an accuracy of <math>\pm 0.1\text{mm}</math>., checking with an outside micrometer. Preparation of plates for a gauge fitting. Exercise on filing radius and angular filing using templates and gauges. Filing templates and gauges for checking lathe tool angles. Exercise on step and taper turning.</p>	<p>Defining and explanation of the elements of interchangeable system basis size, limits, tolerance, allowances. System of limits, fit and tolerances types of fit. Hole basis and shaft basis. Newal, British, I.S.I./B.S.I. systems, examples of fixing limit for various types of fit commonly met within the machine.</p>
11	-Do-	<p>Filing of various angle &amp; clearances of lathe tool on square blanks. Checking with templates &amp; gauge already</p>	<p>Gauges &amp; Template-purpose, types, description and method to use dial test indicator. Limit gauges - purpose,</p>

		<p>prepared. Use of combination &amp; round nose pliers to make different shapes/profiles by bending wire to match the blue print to develop manipulative skills, hand control &amp; eye judgment. Cold riveting. Marking out location of holes for riveting. Use of dolly and snap for forming rivet heads. Lap and butt joint by cold riveting.</p>	<p>types, construction and method to use limit gauges.</p>
12	-Do-	<p>Cutting of sheet metal with chisel. Marking parallel clamp, 'C' clamp or micrometer stand using acquired skills. Simple project work.</p>	<p>Sheet metal work-purpose, types, description and method to use snip &amp; stake. Description and method to use hand shear. Rivets &amp; riveting-types &amp; description of rivets. Method of lap &amp; butt joint using dolly and snap. Cold &amp; hot working of strips &amp; pipes-method of bending solid sections, using fixtures for different physical conditions. Use of cutters for pipes &amp; method to bend in hot and cold condition using fixtures.</p>
13	<p>Plan &amp; perform simple repair, maintenance of different machines and check for functionality. [Different Machines – Drill Machine, Power Saw and Bench Grinder]</p>	<p><b>BASIC MAINTENANCE SKILLS</b> Using hand tools such as screw driver, single end/double end spanners, box nut spanners, ratchet spanners, circlip, pliers, wrenches, pullers, extractors, drift. Correct method to be used and care to be taken in using those tools. Lubrication of different parts of machines. Care and maintenance of <b>machines</b>.</p>	<p><b>BASIC MAINTENANCE SKILLS</b> Screw drivers - purpose, types, description and method to use screw drivers. Spanners- purpose, types, description and method to use box, socket, tubular, hook spanner etc. Wrenches - purpose, types, description and method to use T-socket, monkey, ratchet, pipe wrenches etc. Purpose, description, precautions to be observed and method to use drift, pullers and extractors.</p>
14-17	<p>Prepare different cutting tool to produce jobs to appropriate accuracy by performing different turning operations. [Different cutting tool – V tool, side cutting, parting, thread cutting (both LH &amp; RH),</p>	<p><b>BASIC TURNING</b> Safety precautions to be observed while handling machines. Demonstration of change gear in the gearbox. Practice of holding work piece and tool using different devices. Exercises on plain, stepped, taper and form turning, knurling etc. Exercises on drilling, reaming, boring, counter boring etc. Screw thread cutting both internal and external of different types.</p>	<p><b>TURNING</b> Types, construction features working principles, functions, use accessories and attachments of lathe machine. Driving mechanism – cone pulley, all geared headstock, quick-change gearbox and apron mechanism. Types, materials and angles of the lathe cutting tools. Purpose and method to perform various lathe operations. Using accessories and attachments. Determination and use of cutting</p>

	<p><i>Appropriate accuracy: - <math>\pm 0.06\text{mm}</math>, Different turning operation – Plain, facing, drilling, boring (counter &amp; stepped), grooving, Parallel Turning, Step Turning, parting, chamfering, U -cut, Reaming, knurling.]</i></p>	<p>Exercise on eccentric turning. Grinding of lathe tools. Simple projects such as hollow punch, pulleys, gear blanks, simple coupling etc.</p>	<p>speed, feed. Coolant and its applications. Lubrication system. Periodical maintenance of Lathe.</p>
18-22	<p>Set the different machining parameters and cutters to prepare job by performing different milling operation and indexing. [Different machining parameters – feed, speed and depth of cut. Different milling operations – plain, face, angular, form, gang, straddle milling]</p>	<p><b>BASIC MILLING</b>            Safety precautions in handling machine. Demonstration of various parts of the milling machines. Practice on different work and tool holding devices.            Exercises on:            i) parallel and angular milling.            ii) grooving using mills.            iii) Milling square/hexagon using indexing head.            iv) Use of slotting attachment for cutting key ways.            v) Simple projects such as jaw, claw, Oldham coupling, spline cutting etc. Lubrication of different parts. Care and maintenance of machine.</p>	<p><b>MILLING :</b>            Construction features, working principles, types, functions. Use of accessories and attachment of milling machine. Types of milling cutters. Different method of holding work piece and cutters. Milling operations such as plain, step, angular milling, slot and groove cutting. Gear nomenclature - definitions, symbols, explanation and gear cutting calculations. Explanation of cutting speed, feed and depth of cut. Coolant for different materials. Common fault, defects and their rectification.</p>
23-25	<b>Revision</b>		
26	<b>Examination</b>		

**Note:**

1. More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/ videos of both conventional & CNC machining operation, production of different components, machining of complex job etc., may be shown to the trainees to give a feel of Industry and their future assignment.

## SYLLABUS - OPERATOR ADVANCE MACHINE TOOL

### Second Semester- 06 Months

Week No.	Ref. Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
27-31	Produce components of high accuracy by different operations using grinding. [Different operations – surface grinding, cylindrical grinding with an accuracy of $\pm 0.01$ mm]	<p><b>GRINDING</b></p> <p>Safety precautions to be observed while using machine</p> <p>Demonstration of various parts of the grinding machines.</p> <p>Use of drive - both mechanical and hydraulic.</p> <p>Grinding wheel specifications, mounting, balancing, truing and dressing of grinding wheels.</p> <p>Lubrication of different parts and care &amp; maintenance of grinding machine.</p> <p>Practice on different work holding devices and grinding various jobs.</p>	<p>Types of machines- Constructional features, working principle, types, functions and use of surface and cylindrical grinding machine. Grinding wheels and their specifications - grit, grain, size, structure, bond, grades etc.</p> <p>Procedure to use grinding wheels for balancing and truing. Method to hold work and grind wheel. Method to perform various grinding operation selecting proper speed, Feed.</p> <p>Importance of coolant. Method to detect common faults, their rectification and preventive maintenance of grinding machine. Study of hydraulic system used on the machine.</p>
32	--	<p><b>Other machining process:</b></p> <ul style="list-style-type: none"> <li>✓ Shaping</li> <li>✓ Planning</li> <li>✓ Slotting</li> <li>✓ Hobbing</li> <li>✓ Broaching</li> <li>✓ Finish machining process like</li> </ul> <ul style="list-style-type: none"> <li>• Types</li> <li>• Coated Abrasives (Sandpaper, Emory Cloth)</li> <li>• Belt Grinders</li> <li>• Solid Belt</li> <li>• Mesh Belt (Hold Grinding Fluid via Surface Tension)</li> <li>• Wire Brushing</li> <li>• Wire Provides Metal Cutting/Burnishing Action</li> <li>• Wire (Metal) Acts as Abrasive</li> <li>• Honing (Interior of Holes)</li> <li>• Lapping (Flat Surfaces)</li> <li>• Polishing</li> <li>• Buffing</li> <li>• Electro-Polishing</li> <li>• Magnetic Float Polishing (Ceramic Ball Bearings)</li> <li>• Barrel Finishing</li> <li>• Abrasive Flow</li> </ul>	



33-35	<p>Set different components of machine &amp; parameters to produce taper/angular components and ensure proper assembly of the components.</p> <p><i>[Different component of machine: Form tool, Compound slide, tail stock offset; Different machine parameters- Feed, speed, depth of cut.]</i></p>	<p><b>ADVANCED MACHINING SKILLS TURNING</b></p> <p>Taper turning by using taper attachment.</p> <p>Taper turning by using a form tool.</p> <p>Internal and external taper turning and matching to mating parts.</p> <p>Eccentric turning practice.</p> <p>Boring and stepped boring, position boring.</p>	<p><b>ADVANCED MACHINING SKILLS TURNING</b></p> <p>Taper turning attachment and form tool.</p> <p>Care to be taken for boring, step boring and taper boring in a blind hole.</p> <p>Procedure for cutting various internal and external screw threads. Care to be taken during internal threading in a blind hole. Procedure and care to be taken eccentric turning.</p>
36-37	<p>Set the different machining parameters to produce screw &amp; multi start threaded components applying method/ technique and test for proper assembly of the components</p>	<p>Various Screw thread cutting to suit male and female threaded components.</p> <p>Multi start threads cutting-2start.</p>	
38-45	<p>Set the different machining parameters and cutters to prepare components by performing different milling operation and indexing.</p> <p><i>[Different machining parameters – feed, speed and depth of cut. Different components – Rack, Spur Gear, External Spline, bevel gear, Helical Gear, worm</i></p>	<p><b>MILLING</b></p> <p>Gang milling - milling jobs of different shapes and dimensions by using gang-milling process.</p> <p>Milling hexagonal holes on a plate by attachment.</p> <p>Milling splines (external).</p> <p>Milling gears by both simple and differential indexing</p> <p>Helical milling - milling helical groove on vertical milling machine by a slab mill cutter.</p> <p>Milling helical gears.</p> <p>Milling bevel gears.</p> <p>Milling a rack.</p> <p>Cutting worm and worm wheel on a milling.</p>	<p><b>MILLING</b></p> <p>Different types of milling operations.</p> <p>Indexing methods and its applications.</p> <p>Different types of gear &amp; its application.</p> <p>Different cutters used in gear cutting operations and cutter nomenclature.</p> <p>Procedures for milling helical groove by a slab mill cutter on vertical milling machine. Care and precautions to be taken during milling. Procedure for milling helical gears, bevel gears, rack, worm and worm wheel.</p>

	& work wheel.]		
46	Measure components using different instrument/ gauge and test machine tool accuracy. [Different instrument/ gauges- limit gauges, Sine Bar, snip gauges, tool maker's microscope and profile projector; Simple Machines – Drill Machine, Power Saw and Lathe]	<b>INSPECTION</b> 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.	<b>INSPECTION</b> 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.
47	-Do-	Geometrical accuracy test of machine as per test chart.	Defects and remedies of turning, milling and grinding. Defects such as: Taper, Chattering, Poor Surface finish, Parallelism.
48-49	<b>In-plant training/ Project work (indicative)</b>		
	<ul style="list-style-type: none"> <li>a) Drill extension socket</li> <li>b) V-belt pulley</li> <li>c) Tail Stock Centre (MT – 3)</li> <li>d) Taper ring gauge</li> <li>e) Taper plug gauge. (Morse taper – 3)</li> <li>f) Pedestal bearing</li> <li>g) Crank shaft</li> <li>h) Arbor with clamping nut</li> <li>i) Threaded mandrel</li> <li>j) Quick change tool post</li> </ul>		
50-51	<b>Revision</b>		
52	<b>Examination</b>		

**Note:**

1. Some of the sample project works (indicative only) are given against each semester.
2. Instructor may design their own project and also inputs from local industry may be taken for designing such new project.
3. The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should

## ***Operator Advance Machine Tool***

*demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*

- 4. If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
- 5. More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of both conventional & CNC turning operation, production of different components, turning of complex job, etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

## SYLLABUS- OPERATOR ADVANCE MACHINE TOOL

### Third Semester- 06 Months

Week No.	Ref. Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
53-54	Set (both job and tool) CNC turning centre and produce components as per drawing by preparing part programme.	<b>CNC FUNDAMENTALS</b> Familiarization of computer as CNC works station. Communication between CNC and computer i.e. series, parallel port.	<b>CNC FUNDAMENTALS</b> Background application, block diagram, input devices, output devices, CPU. Memory, Use of computer as CNC workstation. Communication between CNC and computer. Introduction to CNC machine, Types, construction, Different elements of CNC machine, Comparison between conventional machines & CNC machines, Advantages & Disadvantages of CNC machines. Axis designation.
55-57	-Do-	Demo / Identification of different elements of CNC machine Construction & functions, Axis designation	Familiarization with co-ordinate system. Types of co-ordinate system and their applications. Different types/functions of G codes & M codes used in CNC part programming. Different types of interpolation & its applications.
58-61	-Do-	Practice on exercises with different co-ordinate systems with linear & circular interpolation	Cutter Radius comp Tool wear comp Tool nose radius comp Tool nomenclature, tool change command, work & tool offset.
62-69	-Do-	Writing the part program for both turning & milling manually and practice on simulation software. Selection of tools Practice of work & tool offset on simulator.	Introduction to part programming for both turning & milling using geometrical information & technological information (G & M codes) such as feed, speed, depth of cut,.
70-73	-Do-	<b>CNC TURNING</b> 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 auto Single Block and auto continuous mode.	<b>CNC TURNING</b> 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.
74-75	<b>In-plant training/ Project work</b> (Any Project to be done involving CNC machine also)		
	a) Socket With Split Collet		

	b) Screw Jack c) Crank Shaft With Taper Sleeve
76-77	<b>Revision</b>
78	<b>Examination</b>

**Note:**

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of both conventional & CNC turning operation, production of different components, turning of complex job, etc., may be shown to the trainees to give a feel of Industry and their future assignment.*

## SYLLABUS- OPERATOR ADVANCE MACHINE TOOL

### Fourth Semester- 06 Months

Week No.	Ref. Learning Outcome	Professional Skills (Trade Practical)	Professional Knowledge (Trade Theory)
79-83	Set (both job and tool) CNC machining centre and produce components as per drawing by preparing part programme.	Practice of contour program for different profiles on CNC simulation software	Concept of contour programming for different profiles.
84-86	-Do-	Practice on CNC lathe. TURNING - parallel, taper, step, radius, groove and threads of different pitches.	Program for different cycles such as stock removal, Grooving, Threading, Undercut & canned/ fixed cycles Tool type chart, TNRC(G41 and G42). Surface finish-Primary and Secondary. Surface roughness related BIS symbols.
87-90	-Do-	<b>CNC MILLING</b> 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 auto SBL and auto cont. mode.	<b>CNC MILLING</b> 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.
91-95	-Do-	Practice on CNC Milling such as Face milling, Edge milling, slot milling (Radial & circumferential), Pocket milling ( square & circular), Application of Canned/Fixed cycles	Programming for different operation such as Face milling, Edge milling, Slot milling(radial & circumferential) Tool type chart, Application and effect of Cutter radius compensation (G41 and G42). Surface finish- Primary and Secondary. Surface roughness related BIS symbols Programming for Pocket milling (square & circular) & Canned / Fixed cycles for hole machining.
96	-Do-	Prepare different Types of documentation as per industrial need by	Importance of Technical English terms used in industry –(in simple

		different methods of recording information	definition only) Technical forms, process charts, activity logs, in required formats of industry, estimation, cycle time, productivity reports, job cards.
97-98	-Do-	Practice of contour program for different profiles on CNC simulation software.	Concept of contour programming for different profiles.
99	Plan and perform simple repair and maintenance of different machines and check for functionality. <i>[Different Machines – Drilling Machine, milling machine and Lathe]</i>	Practice on routine maintenance, Periodic checking for lubrication, Hydraulic oil level, Hydraulic system pressure, chuck Pressure adjustment for different material. Cleaning & adjusting the Pneumatic Filter, Pressure regulator & Lubricator.	<b>Preventive Maintenance, Predictive Maintenance &amp; Concepts of TPM.</b> Difference between breakdown and preventive maintenance – Its importance in productivity, types. Normal procedure followed for maintenance of machine tool in the shop floor. Importance of centralized lubrication system, Hydraulics & pneumatics.
100-101	<b>In-plant training/ Project work</b> (Any Project to be done involving CNC machine also)  a) Crank and slotted link mechanism b) Stub arbor with collet and nuts c) Compound gear train		
102-103	<b>Revision</b>		
104	<b>Examination</b>		

**NOTE:**

1. *Some of the sample project works (indicative only) are given against each semester.*
2. *Instructor may design their own project and also inputs from local industry may be taken for designing such new project.*
3. *The project should broadly covered maximum skills in the particular trade and must involve some problem solving skill. Emphasis should be on Teamwork: Knowing the power of synergy/ collaboration, Work to be assigned in a group (Group of at least 4 trainees). The group should demonstrate Planning, Execution, Contribution and application of Learning. They need to submit Project report.*
4. *If the instructor feels that for execution of specific project more time is required than he may plan accordingly to produce components/ sub-assemblies in appropriate time i.e., may be in the previous semester or during execution of normal trade practical.*
5. *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of both conventional & CNC turning operation, production of different components, turning of complex job, etc., 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

First Semester Duration: Six Months		
S No.	Workshop Calculation and Science	Engineering Drawing
1.	<b>Unit:</b> Systems of unit- FPS, CGS, MKS/SI unit, unit of length, Mass and time, Conversion of units	Engineering Drawing: Introduction and its importance <ul style="list-style-type: none"> <li>- Relationship to other technical drawing types</li> <li>- Conventions</li> <li>- Viewing of engineering drawing sheets</li> <li>- Method of Folding of printed Drawing Sheet as per BIS SP:46-2003</li> </ul>
2.	<b>Fractions:</b> Fractions, Decimal fraction, L.C.M., H.C.F., Multiplication and Division of Fractions and Decimals, conversion of Fraction to Decimal and vice versa. Simple problems using Scientific Calculator.	Drawing Instruments: their Standard and uses <ul style="list-style-type: none"> <li>- 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.</li> </ul>
3.	<b>Square Root:</b> Square and Square Root, method of finding out square roots, Simple problem using calculator.	Lines: <ul style="list-style-type: none"> <li>- Definition, types and applications in Drawing as per BIS SP:46-2003</li> <li>- Classification of lines (Hidden, centre, construction, Extension, Dimension, Section)</li> <li>- Drawing lines of given length (Straight, curved)</li> <li>- Drawing of parallel lines, perpendicular line</li> <li>- Methods of Division of line segment</li> </ul>
4.	<b>Ratio &amp; Proportion:</b> Simple calculation on related problems.	Drawing of Geometrical Figures: Definition, nomenclature and practice of <ul style="list-style-type: none"> <li>- Angle: Measurement and its types, method of bisecting.</li> <li>- Triangle-different types</li> <li>- Rectangle, Square, Rhombus,</li> </ul>



		<p>Parallelogram.</p> <ul style="list-style-type: none"> <li>- Circle and its elements.</li> </ul>
5.	<p><b><u>Percentage</u></b>: Introduction, Simple calculation. Changing percentage to decimal and fraction and vice-versa.</p>	<p>Lettering and Numbering as per BIS SP46-2003:</p> <ul style="list-style-type: none"> <li>- Single Stroke, Double Stroke, inclined, Upper case and Lower case.</li> </ul>
6.	<p><b><u>Material Science</u></b>: Properties- Physical &amp; Mechanical, Types–Ferrous &amp; Non-Ferrous, difference between Ferrous and Non-Ferrous metals, introduction of Iron, Cast Iron, Wrought Iron, Steel, difference between Iron and Steel, Alloy steel, carbon steel, stainless steel, Non-Ferrous metals, Non-Ferrous Alloys.</p>	<p>Dimensioning:</p> <ul style="list-style-type: none"> <li>- Definition, types and methods of dimensioning (functional, non-functional and auxiliary)</li> <li>- Types of arrowhead</li> <li>- Leader Line with text</li> </ul>
7.	<p><b><u>Mass, Weight and Density</u></b>: Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density, specific gravity of metals.</p>	<p>Free hand drawing of</p> <ul style="list-style-type: none"> <li>- Lines, polygons, ellipse, etc.</li> <li>- geometrical figures and blocks with dimension</li> <li>- Transferring measurement from the given object to the free hand sketches.</li> </ul>
8.	<p><b><u>Speed and Velocity</u></b>: Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation, equations of motions, simple related problems.</p>	<p>Sizes and Layout of Drawing Sheets</p> <ul style="list-style-type: none"> <li>- Basic principle of Sheet Size</li> <li>- Designation of sizes</li> <li>- Selection of sizes</li> <li>- Title Block, its position and content</li> <li>- Borders and Frames (Orientation marks and graduations)</li> <li>- Grid Reference</li> <li>- Item Reference on Drawing Sheet (Item List)</li> </ul>
9.	<p><b><u>Work, Power and Energy</u></b>: 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.</p>	<p>Method of presentation of Engineering Drawing</p> <ul style="list-style-type: none"> <li>- Pictorial View</li> <li>- Orthogonal View</li> <li>- Isometric view</li> </ul>
10.	<p>-----</p>	<p>Symbolic Representation (as per BIS SP:46-2003) of:</p> <ul style="list-style-type: none"> <li>- Fastener (Rivets, Bolts and Nuts)</li> </ul>

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		<ul style="list-style-type: none"><li>- Bars and profile sections</li><li>- Weld, brazed and soldered joints.</li><li>- Electrical and electronics element</li><li>- Piping joints and fittings</li></ul>
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<b>Second Semester</b>		
<b>Duration: Six Months</b>		
<b>S No.</b>	<b>Workshop Calculation and Science</b>	<b>Engineering Drawing</b>
1.	<b>Algebra:</b> Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables).	Construction of Scales and diagonal scale
2.	<b>Mensuration:</b> 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.	Practice of Lettering and Title Block
3.	<b>Trigonometry:</b> Trigonometrical ratios, measurement of angles.  Trigonometric tables	Dimensioning practice: <ul style="list-style-type: none"> <li>- Position of dimensioning (unidirectional, aligned, oblique as per BIS SP:46-2003)</li> <li>- Symbols preceding the value of dimension and dimensional tolerance.</li> <li>- Text of dimension of repeated features, equidistance elements, circumferential objects.</li> </ul>
4.	<b>Heat &amp; Temperature:</b> 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.	Construction of Geometrical Drawing Figures: <ul style="list-style-type: none"> <li>- Different Polygons and their values of included angles. Inscribed and circumscribed polygons.</li> <li>- Conic Sections (Ellipse &amp; Parabola)</li> </ul>
5.	<b>Basic Electricity:</b> 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	Drawing of Solid figures (Cube, Cuboids, Cone, Prism, Pyramid, Frustum of Cone and Pyramid.) with dimensions.

	power, energy, unit of electrical energy.	
6.	<p><b><u>Levers and Simple Machines:</u></b> Levers and its types.</p> <p>Simple Machines, Effort and Load, Mechanical Advantage, Velocity Ratio, Efficiency of machine, Relationship between Efficiency, velocity ratio and Mechanical Advantage.</p>	Free Hand sketch of hand tools and measuring tools used in respective trades.
7.	---	<p>Projections:</p> <ul style="list-style-type: none"> <li>- Concept of axes plane and quadrant.</li> <li>- Orthographic projections</li> <li>- Method of first angle and third angle projections (definition and difference)</li> <li>- Symbol of 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection as per IS specification.</li> </ul>
8.	--	Drawing of Orthographic projection from isometric/3D view of blocks
9.	--	Orthographic Drawing of simple fastener (Rivet, Bolts, Nuts & Screw)
10.	--	Drawing details of two simple mating blocks and assembled view.

<b>Third Semester</b>		
<b>Duration: Six Months</b>		
<b>S No.</b>	<b>Workshop Calculation and Science</b>	<b>Engineering Drawing</b>
1.	- Geometrical construction & theorem: division of line segment, parallel lines, similar angles, perpendicular lines, isosceles triangle and right angled triangle.	- Revision of first year topics.
2.	- Area of cut-out regular surfaces: circle and segment and sector of circle.	- Machined components; concept of fillet & chamfer; surface finish symbols.
3.	- Area of irregular surfaces. - Application related to shop problems.	- Screw thread, their standard forms as per BIS, external and internal thread, conventions on the features for drawing as per BIS.
4.	- Volume of cut-out solids: hollow cylinders, frustum of cone, block section. - Volume of simple machine blocks.	- Free hand Sketches for bolts, nuts, screws and other screwed members.
5.	- Material weight and cost problems related to trade.	- Standard rivet forms as per BIS (Six types).
6.	- Finding the value of unknown sides and angles of a triangle by trigonometrical method.	- Riveted joints-Butt & Lap (Drawing one for each type).
7.	- Finding height and distance by trigonometry.	- Orthogonal views of keys of different types
8.	- Application of trigonometry in shop problems. (viz. taper angle calculation).	- Free hand sketches for simple pipe, unions with simple pipe line drawings.
9.	- Forces definition. - Compressive, tensile, shear forces and simple problems. -Stress, strain, ultimate strength, factor of safety. -Basic study of stress-strain curve for MS.	- Concept of preparation of assembly drawing and detailing. Preparation of simple assemblies & their details of trade related tools/job/exercises with the dimensions from the given sample or models.
10.	- Temperature measuring instruments. Specific heats of solids & liquids.	-Free hand sketch of trade related components/ parts (viz., single tool post for the lathe, etc.)
11.	- Thermal Conductivity, Heat loss and heat gain.	- Study of assembled views of Vee-blocks with clamps.
12.	- Average Velocity, Acceleration & Retardation. - Related problems.	- Study of assembled views of shaft and pulley.
13.	- Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force	- Study of assembled views of bush bearing.

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14.	--	- Study of assembled views of a simple coupling.
15.	--	- Free hand sketching of different gear wheels and nomenclature.

Fourth Semester		
Duration: Six Months		
S No.	Workshop Calculation and Science	Engineering Drawing
1.	<p><b>Graph:</b></p> <ul style="list-style-type: none"> <li>- Read images, graphs, diagrams</li> <li>- bar chart, pie chart.</li> <li>- Graphs: abscissa and ordinates, graphs of straight line, related to two sets of varying quantities.</li> </ul>	<ul style="list-style-type: none"> <li>- Free hand details and assembly of simple bench vice.</li> </ul>
2.	<p>Simple problem on Statistics:</p> <ul style="list-style-type: none"> <li>- Frequency distribution table</li> <li>- Calculation of Mean value.</li> <li>- Examples on mass scale productions.</li> <li>- Cumulative frequency</li> <li>- Arithmetic mean</li> </ul>	<ul style="list-style-type: none"> <li>- Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.</li> </ul>
3.	<p>Acceptance of lot by sampling method (within specified limit size) with simple examples (not more than 20 samples).</p>	<ul style="list-style-type: none"> <li>- Simple exercises relating missing symbols.</li> <li>- Missing views</li> </ul>
4.	<ul style="list-style-type: none"> <li>- Friction- co-efficient of friction, application and effects of friction in Workshop practice.</li> </ul> <p><b>Centre of gravity</b> and its practical application.</p>	<ul style="list-style-type: none"> <li>- Simple exercises related to missing section.</li> </ul>
5.	<ul style="list-style-type: none"> <li>- Magnetic substances- natural and artificial magnets.</li> <li>- Method of magnetization. Use of magnets.</li> </ul>	<ul style="list-style-type: none"> <li>- Free hand sketching of different types of bearings and its conventional representation.</li> </ul>
6.	<ul style="list-style-type: none"> <li>- Electrical insulating materials.</li> <li>- Basic concept of earthing.</li> </ul>	<ul style="list-style-type: none"> <li>- Solution of NCVT test.</li> <li>- Simple exercises related to trade related symbols.</li> <li>- Basic electrical and electronic symbols.</li> </ul>
7.	<ul style="list-style-type: none"> <li>- Transmission of power by belt, pulleys &amp; gear drive.</li> <li>- Calculation of Transmission of power by belt pulley and gear drive.</li> </ul>	<ul style="list-style-type: none"> <li>- Study of drawing &amp; estimation of materials.</li> </ul>
8.	<ul style="list-style-type: none"> <li>- Heat treatment and advantages.</li> </ul>	<ul style="list-style-type: none"> <li>- Solution of NCVT test papers.</li> </ul>
9.	<p>Concept of pressure – units of pressure, atmospheric pressure, absolute pressure, gauge pressure – gauges used for measuring pressure.</p>	
10.	<p>Introduction to pneumatics &amp; hydraulics systems.</p>	

## 9.2 EMPLOYABILITY SKILLS

<b>CORE SKILL – EMPLOYABILITY SKILL</b>	
<b>First Semester</b>	
<b>1. English Literacy</b>	
<b>Duration : 20 hrs</b>	
<b>Marks : 09</b>	
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 known people, 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 on messages and filling in message forms, greeting and introductions, office hospitality, resumes or curriculum vitae essential parts, letters of application reference to previous communication.
<b>2. IT Literacy</b>	
<b>Duration : 20 hrs</b>	
<b>Marks : 09</b>	
Basics of Computer	Introduction, computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down computer.
Computer Operating System	Basics of Operating System, WINDOWS, 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 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,



	<p>Concept of Internet (Network of Networks),  Meaning of World Wide Web (WWW), Web browser, Website, 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.</p>
<b>3. Communication Skills</b>	
<b>Duration : 15 hrs</b> <b>Marks : 07</b>	
Introduction to Communication Skills	<p>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.</p>
Listening Skills	<p>Listening-hearing and listening, effective listening, barriers to effective listening, guidelines for effective listening.  Triple- A Listening - Attitude, Attention &amp; Adjustment.  Active listening skills.</p>
Motivational Training	<p>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.</p>
Facing Interviews	<p>Manners, etiquettes, dress code for an interview.  Do's &amp; Don'ts for an interview.</p>
Behavioral Skills	<p>Problem solving, confidence building, attitude.</p>
<b>Second Semester</b>	
<b>4. Entrepreneurship Skills</b>	
<b>Duration : 15 hrs</b> <b>Marks : 06</b>	
Concept of Entrepreneurship	<p>Entrepreneur - Entrepreneurship - Enterprises: Conceptual issue  Entrepreneurship vs. management, Entrepreneurial motivation.  Performance &amp; Record, Role &amp; Function of entrepreneurs in relation to the enterprise &amp; relation to the economy, Source of business ideas,</p>

	Entrepreneurial opportunities, and 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. Difference between small scale & large scale business, Market survey, Method of marketing, Publicity and advertisement, Marketing mix.
Institution's 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 familiarize 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.
<b>5. Productivity</b>	
	<b>Duration : 10 hrs</b> <b>Marks : 05</b>
Benefits	Personal/ Workman - Incentive, Production linked Bonus, Improvement in living standard.
Affecting Factors	Skills, Working Aids, Automation, Environment, Motivation - How it improves or slows down productivity.
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.
<b>6. Occupational Safety, Health and Environment Education</b>	
	<b>Duration : 15 hrs</b> <b>Marks : 06</b>
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 hygiene, 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.
<b>7. Labour Welfare Legislation</b>	
<b>Duration : 05 hrs</b> <b>Marks : 03</b>	
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.
<b>8. Quality Tools</b>	
<b>Duration : 10 hrs</b> <b>Marks : 05</b>	
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.

<b>LIST OF TOOLS AND EQUIPMENT</b>			
<b>OPERATOR ADVANCE MACHINE TOOL (For batch of 12 candidates)</b>			
<b>S No.</b>	<b>Name of the Tools &amp; Equipment</b>	<b>Specification</b>	<b>Quantity</b>
<b>A. TRAINEES TOOL KIT</b>			
1.	Screw drivers	150 mm	13 nos.
2.	Screw driver star		2 set
3.	Long nose plier	150mm.	13 nos.
4.	Combination plier	150mm.	13 nos.
5.	Diagonal cutter	150mm.	13 nos.
6.	Adjustable spanner or side wrench		13 nos.
7.	Hack saw frame adjustable	250 - 300mm. with blades	13 nos.
8.	Flat file	200mm.	13 nos.
9.	File triangular	150 mm.	13nos.
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	750 gms. With handle	11 nos.
15.	Hammer small	250gms. With handle	11 nos.
16.	Neon tester		2 nos.
17.	Grease Gun		1 nos.
18.	Bearing Extractor		1 no.
<b>B. INSTRUMENTS AND GENERAL SHOP OUTFIT</b>			
19.	Steel rule	30 cm. Graduated both in English and Metric unit.	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 250mm. (bearing).	11 nos.
27.	Scraper	B 250mm. (triangular).	11 nos.
28.	Scraper	C 250mm. (half round).	11 nos.

### *Operator Advance Machine Tool*

29.	Scriber	150x3 mm. (one side offset).	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 2 <sup>nd</sup> .Cut	250mm.	11 nos.
35.	Chisel flat	25x 200mm.	11 nos.
36.	Surface plate	400mm.X 400mm. Grade 1. With stand	2 nos.
37.	Marking off table	1200x 1200 x 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 steel meter		2 nos.
45.	Straight edge steel	500mm.	2 nos.
46.	Steel tape 2 meter in case		1 no.
47.	Sprit level	2V 250, 05 meter	2 nos.
48.	Combination set	300 mm.	3 nos.
49.	Hexagonal allen keys	2.5 to 12mm.	11 sets
50.	Spanner D.E.	6mm to 32mm assorted	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	250 x 150 x 175 mm.	5 nos
54.	Solid parallels in pairs (different sizes) metric		13 nos.
55.	Oil can pressure feed	500 mg.	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	3 mm. To 13 mm. (parallel shank)	3 sets
60.	Drill chuck	0-12 mm with taper shank	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

### Operator Advance Machine Tool

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	6mm. square	1 doz.
72.	Tool bits HSS	10mm. square	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	75mm. jaw swivel base	2 nos.
77.	Machine vice	200mm. swivel base	4 nos.
78.	Machine vice	160mm. swivel base	2 nos.
79.	Hand vice	50mm. jaw	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 & shapes (throw away tips)		3 sets

#### C. MILLING CUTTERS

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 sets

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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	10, 12mm. straight shank	6 nos.
99.	T-slot cutter to suit T-headed bolt	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.

#### D. MEASURING INSTRUMENTS

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 150mm. blade	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 type I grade A with magnetic base		2 nos
119.	Centre gauge	60 <sup>0</sup>	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

#### E. GENERAL FURNITURE

### Operator Advance Machine Tool

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.	First Aid Box		1 no.
<b>F. GENERAL MACHINERY SHOP OUTFIT</b>			
137.	Lathe S.S & S.C.(all geared type)	with minimum specification as: 150 mm center height, 1000 mm between centers, along with 4-jaw & 3-jaw chucks, auto feed system, taper turning attachment, Motorized coolant system, safety guard, dog carriers, face plate and machine light arrangement.	3 nos.
138.	Drilling machine pillar type	20mm. capacity with drill chuck & key.	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 motorized supplied with	1 no.



### Operator Advance Machine Tool

		magnetic chuck 250mm.x 120mm. diamond tool holder, set of spanner, grease etc.	
142.	Cylindrical grinding machine	with internal grinding attachments with minimum specification as: To accommodate 750mm job with centre height 150mm. Wheel diameter x width = 300 x 25mm.	1 no.
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 nos.
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 (@)	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 trainees + 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

**NOTE:**

- a) No additional items are required to be provided to the batch working in the second and third shift except the items under trainee's lockers.

***Operator Advance Machine Tool***

- b) (@)-Only one number need be provided in each I.T.I. irrespective of No. of Units.
- c) Institute having centralized computer lab may use the existing infrastructure to impart simulation training & in that case not required to procure item no. 146

<b>TOOLS &amp;EQUIPMENTS FOR EMPLOYABILITY SKILLS</b>		
<b>S No.</b>	<b>Name of the Equipment</b>	<b>Quantity</b>
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.
<b><i>Note: Above Tools &amp;Equipments not required, if Computer LAB is available in the institute.</i></b>		

**FORMAT FOR INTERNAL ASSESSMENT**

<b>Name &amp; Address of the Assessor:</b>						<b>Year of Enrollment:</b>								
<b>Name &amp; Address of ITI (Govt./Pvt.):</b>						<b>Date of Assessment:</b>								
<b>Name &amp; Address of the Industry:</b>						<b>Assessment location: Industry / ITI</b>								
<b>Trade Name:</b>			<b>Semester:</b>			<b>Duration of the Trade/course:</b>								
<b>Learning Outcome:</b>														
S No.	Maximum Marks (Total 100 Marks)		15	5	10	5	10	10	5	10	15	15	Total Internal Assessment Marks	Result (Y/N)
	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		
1														
2														