

Curriculum for Mechanical Machinist (One year)



Overall objective of course

Name of course: Mechanical Machinist (One Year)

The Mechanical field, which is at times classified as a mother technology, is a vast field which assists and supports other fields. The advancement and development of technology has also impacted in the up-gradation of its functions & processes and now plays a very significant role in the industry. The content of this curriculum was designed whilst keeping in view the industrial demand and their future requirements, focusing on skill requirements, machine cutting operations ranging from the conventional to the automatic process along with required theoretical knowledge that trainees will need, in order to produce a capable & skillful work force.

The curriculum covers the major topics of hand operation techniques, drill operation techniques, fastening methods, measuring, grinding, turning, shaping milling, tool and cutter grinding, CNC lathe machine, CNC milling machine along with technical drawing and technical mathematics.

Competencies gained after completion of course

On successful completion of this course, the trainee should be able to:

- Explain the bench work relating to safety precautions, hand tools, perception of filing, polishing, chipping, tapping, threading, reaming and joining of mechanical parts.
- Explain the measuring tools.
- Explain the use of drill machine operations.
- Explain the making of the bench jobs as per given drawing
- Explain the different fastening methods
- Describe the grinding machine for different operations
- Define the use of lathe machine.
- Explain different operations on lathe machine (simple to complex exercises).
- Explain the different shaping operations (simple to complex exercises)
- Describe the milling machines.
- Explain the different operations on milling machine (simple to complex exercises)
- Tell about the CNC lathe machine
- Explain the different operations on CNC lathe machine
- Describe the CNC milling machine.
- Explain the different operations on CNC milling machine.
- Define with the ethical values.
- Use the hand tools safely & properly
- Use the measuring tools properly
- Use the drill machine safely

- Make the bench jobs as per given drawing
- Perform the different fastening methods
- Use the lathe machine properly
- Work on the milling machines properly
- Use the surface grinding machine properly
- Operate the CNC lathe machine properly
- Perform the different operations on CNC lathe machine
- Operate the CNC milling machine properly
- Perform the different operations on CNC milling machinery
- Prepare the drawing works related to mechanical machinist (simple to complex exercises)
- Calculate and apply the mathematics works related to mechanical machinist (simple to complex exercises)
- Adopt and comply with the ethical values.

Job opportunities available immediately and in the future

The pass outs of this course may find job / employment opportunities in the following areas:-

- Fertilizer plants.
- Chemical plants.
- Pharmaceutical industry.
- Cement plants.
- Oil refineries.
- Automobile industry.
- Sugar plants.
- Power plants.
- Papers and board industry.
- Packaging industry.
- Private & government workshops.
- Own workshop

Curriculum Salient Points:

Name of course:	Mechanical-Machinist
Entry level:	Matric / middle
Duration of course:	1 year (4 Module)
Training hours :	1600 hours 400 hours per Module 40 hours / week 7 hours per day (Friday 5 hours.)
Training methodology:	Practical 80% Theory 20%
Medium of instruction :	Urdu / English

Overview about the program –curriculum for Mechanical-Machinist

Module Title and Aim	Learning Units	Theory hours	Workplace hours
<p style="text-align: center;">Module 1: Bench workshop operations, drilling, shaping, and grinding operations</p> <p>Aim: To be able to perform filling, drilling, threading (internal +external), riveting, grinding of shaper tools and grinding of cutters.</p>	1.1 Understand and perform bench workshop operation. 1.2 Perform Shaping operation. 1.3 Perform Tool and cutter grinding.	40 hours 25 hours 15 hours	160 hours 80 hours 80 hours
<p style="text-align: center;">Module 2: Lathe operations</p> <p>Aim: This module covers the competencies required to perform all common and complex Lathe operations using conventional lathe machine and related accessories, ensuring safe working condition, use of tools, equipments and materials.</p>	2.1 Explain the construction of lathe machine, their attachment, accessories and tools 2.2 understand and perform the basic mathematical calculation 2.3 Perform lathe operations 2.4 Explain the safety precaution and procedures	30 hours 25 hours 20 hours 05 hours	10 hours 290 hours 18 hours 02 hours
<p style="text-align: center;">Module 3: Milling operations</p> <p>Aim: This module covers the competencies required to perform common/complex milling Operation and produce commonly used gears such as rack, spur, helical, bevel and Other gears ensuring safe working conditions and safe use of tools, equipment Material and machinery.</p>	3.1 Describe the construction of milling machine, their attachment, accessories and tools. 3.2 understand and perform the basic mathematical calculation 3.3 Perform milling operations 3.4 Observe the safety precaution and procedures	30 hours 25 hours 20 hours 05 hours	10 hours 18 hours 290 hours 02 hours
<p style="text-align: center;">Module 4: Perform turning and milling operations by using computer numerical control (CNC) machines</p> <p>Aim: This module covers the competencies required to use computer numerical control (CNC) Lathe and milling machines for different operations and related accessories, ensuring safe working conditions & use of tools, equipment, machinery and material.</p>	4.1 Construction of CNC lathe machine, their attachment, accessories and tools 4.2 Prepare and perform programming for CNC lathe, setting of job and tools 4.3 Perform on CNC lathe 4.4 Understand the construction of CNC milling, their attachment, accessories and tools 4.5 Perform programming for CNC milling, setting of job and tools 4.6 Perform CNC milling	10 hours 20 hours 10 hours 10 hours 20 hours 10 hours	20 hours 40 hours 100 hours 20 hours 40 hours 100 hours
Total		320 hrs	1280 hrs

Mechanical Machinist (One year) Curriculum Contents (Teaching and Learning Guide)

Module 1 Title: Bench workshop operations, drilling, shaping and grinding Operations
Objective of the Module: To be able to perform filling, drilling, threading (internal +external), riveting, grinding of shaper tools and grinding of cutters.
Duration: 400 hours Theory: 80 hours. Practice: 320 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1. Understand and perform bench workshop operation.	1.1 Identify the bench workshop tools	<ul style="list-style-type: none"> ❖ Perform different filling operation, Parallel filling, Square filling etc. ❖ Do profile filling with key file, needle file set ❖ Perform riveting. ❖ Perform sawing with hand hacksaw. ❖ Perform threading by die and taps 	Th . 06Hours Pract. 70Hours	Hand Tools & Measuring Tools	Theory in class room. Practical in related work shop. Note: Tool and machinery/ equipment list attach at the end of curriculum.
	1.2 Perform basic bench workshop operations.	<ul style="list-style-type: none"> ❖ Recognize the bench workshop tools and their applications ❖ Use of bench work shop tools 	Th. 06Hours Pract. 10Hours	Mild steel, medium carbon steel, brass.	
	1.3 Identify the working and measuring tool and theirs applications	<ul style="list-style-type: none"> ❖ Understand and use of marking tools ❖ Perform marking as per given drawing ❖ Understand and use of measuring tools ❖ Perform with steel rule, venires caliper (external and internal depth), micrometer and bevel protector. 	Th 06Hours Pract. 10Hours	Mild steel, medium carbon steel, brass. Measuring Tools	
	1.4 Perform on drilling machine	<ul style="list-style-type: none"> ❖ Understand the construction of different type of drill machines ❖ Apply safety on drill machine ❖ Perform drilling on marked point 	Th .08Hours Pract. 60Hours	Drill Machine with accessories	
	1.5 Perform basic mathematical calculation	<ul style="list-style-type: none"> ❖ Calculate cutting speed and RPM on drilling machine ❖ Calculate the size for internal and external threading ❖ Calculate the reamer size ❖ Calculate rivets size 	Th .14Hours Pract. 10Hours	Drill Machine with accessories	

2 Perform shaping operations.	2.1 Explain the construction of shaping machine	<ul style="list-style-type: none"> ❖ Introduce the shaping machine parts, accessories and attachments ❖ Use of shaping machine. ❖ Describe the kinds of shaping machine 	Th .06Hours Pract. 06Hours	Shaper Machine with accessories	
	2.2 Do the setting and application on shaping machine	<ul style="list-style-type: none"> ❖ Calculate stroke per minute and feed ❖ Set the shaping machine for operations ❖ Set stroke position according to the job ❖ Select the required cutting tool and clamping device 	Th .08Hours Pract. 10Hours	Shaper Machine with accessories	
	2.3 Perform on shaping machine	<ul style="list-style-type: none"> ❖ Perform parallel shaping ❖ Perform step shaping ❖ Perform grooving and slot shaping ❖ Perform Angular shaping ❖ Perform fitting on shaper 	Th .06Hours Pract.60Hours	Mild steel, medium carbon steel, brass. Measuring Tools	
	2.4 Understand the safety precautions and procedures	<ul style="list-style-type: none"> ❖ Apply safety rule for shaping ❖ Observe personal safety rules ❖ Observe tool & work safety rules 	Th .05Hours Pract. 04Hours	Computer, Multimedia, White board etc	
3 Perform tool and cutter grinding.	3.1 Describe the construction of grinding machine	<ul style="list-style-type: none"> ❖ Understand the grinding machine ❖ Identify the different type of grinding machines ❖ Identify the attachment of tool and cutter grinder 	Th .04Hours Pract. 06Hours	Pedestal grinder, Tool &Cutter grinder	
	3.2 Perform on pedestal grinding machine	<ul style="list-style-type: none"> ❖ Perform tool grinding on right hand side tool, right hand roughing tool, round nose tool and parting off tool ❖ Perform cutter grinding! End mill, side & face, shell end mill, Plain milling cutter. 	Th .06Hours Pract.30Hours	Pedestal grinder	
	3.3 Perform on Tool & Cutter grinding machine	<ul style="list-style-type: none"> ❖ Describe the tools and cutters ❖ Set the job and tool for cutter grinder ❖ Grind the tools and cutters. 	Th .02Hours Pract. 40Hours	Tool & Cutter grinding machine	
	3.4 Apply safety precautions and procedures	<ul style="list-style-type: none"> ❖ Apply safety rules for grinding ❖ Observe personal safety rules ❖ Observe tool safety rules 	Th .03Hours Pract. 04Hours	Computer, Multimedia, White board etc	

Assessment

Module 01: Bench workshop operations, drilling, shaping and grinding Operations

Learning Units	Theory Days/ hours	Workplace Days/ hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1. Understand and perform bench workshop operations.	40 hours	160 hours	<ul style="list-style-type: none"> ❖ Explain the name of bench work shop tool and their uses, safety rules on bench workshop. ❖ Demonstrate the marking of job ❖ Demonstrate filling, sawing, threading and reaming of job. 	Short answer questions Practical demonstration On job Practical demonstration on job	
2. Perform shaping operations.	25 hours	80 hours	<ul style="list-style-type: none"> ❖ Explain the shaping machine it part, accessories and attachment and their use ❖ Calculate shaper speed(stock per minute) ❖ And feed ❖ Demonstration different shaping operation on job 	Oral questions Short answer questions Practical demonstration on job	
3. Perform tool and cutter grinding.	15 hours	80 hours	<ul style="list-style-type: none"> ❖ Explain the different type of grinding machine, angles of tools and safety on grinding ❖ Demonstration on tools and cutter grinding 	Oral questions Practical demonstration	

Supportive Notes

Assessment context:

- This unit has to be assessed on the job, off the job, or a combination of on and off the job demonstrated by an individual work.

Critical aspects :-

- Selection of drills, marking out accuracy, centering, securing work pieces, grinding angles of tool should remain unchanged after grinding. Use protective goggles especially for eye protection. Grinding wheel should be selected to suit the grain size, bond, type and material of tool. Grinding machine should not be operated without wheel guard. Smoothness and accuracy of the grinded surface.

Assessment condition:-

- Each unit should be assessed separately.
- The candidate will have to access all tools, equipment, material and demonstrations required.
- The candidate will be permitted to refer any relevant drawings.
- The candidate will be required orally or by other methods of communication to answer questions asked by the assessor
- Present evidence related to the skills
- Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by criteria and that he possesses the required under pinning knowledge and skill.

Resources required for assessment:-

- It includes all tools, equipment and related material, listed in the curriculum

Module 2 title: Lathe Operations

Objective of the Module: This module covers the competencies required to perform all common and complex Lathe operations using conventional lathe machine and related accessories, ensuring safe working condition, use of tools, equipments and materials:

Duration: 400 hours Theory 80 hours Practical 320 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1 Explain the construction of lathe machine, their attachment, accessories and tools	1.1 Explain the construction of lathe machine and their uses.	<ul style="list-style-type: none"> ❖ Recognized the parts of lathe machine and their uses. ❖ Identified and remove the faults under the supervision of Instructor. 	Th .08Hours Pract.04Hours	Lathe Machine with accessories	Theory in class room. Practical in related work shop/lab. Note: Tool and machinery/ equipment list attached at the end of curriculum
	1.2 Use the attachment of lathe machine.	<ul style="list-style-type: none"> ❖ Recognized the main attachments of lathe machine ❖ Mount and remove the attachments. ❖ Use the attachments. 	Th .08Hours Pract.04Hours	Lathe Machine with attachments	
	1.3 Identify the lathe tools and their settings.	<ul style="list-style-type: none"> ❖ Prepare tools for required operation i.e. facing, turning, fine profile and threading (internal/external). ❖ Apply knowledge of all kinds of turning and thread tool angles. 	Th .04Hours Pract. 02Hours	Mild steel, medium carbon steel, brass.	
2 Perform the basic mathematical calculation.	2.1 Apply the knowledge of calculation for lathe machine operations.	<ul style="list-style-type: none"> ❖ Calculate cutting speed, RPM and feed ❖ Calculate and set the lead for thread cutting. ❖ Calculate the machining time. ❖ Application of gained knowledge on the lathe machine 	Th .08Hours Pract. 06Hours	Computer, Multimedia, White board etc	
	2.2 Apply the knowledge of jobs calculation	<ul style="list-style-type: none"> ❖ Calculate all kind of threads, characteristics etc ❖ Define and calculate ISO fits (max ,min ,off size) ❖ Calculate the tapered size and taper ratio. ❖ Application of gained knowledge 	Th .12Hours Pract. 12Hours	Computer, Multimedia, White board etc	
3 Perform lathe operations	3.1 Select the tools and clamping device for turning.	<ul style="list-style-type: none"> ❖ Identify the required tools and clamping device for the job. ❖ Mount the holding device and clamp the job properly. ❖ Hold the tool and set the centre position. 	Th .12Hours Pract. 20Hours	Lathe Machine with accessories and Turning Tools	

	3.2 perform turning operations.	<ul style="list-style-type: none"> ❖ Perform turning operations, facing, parallel turning, taper turning, thread cutting by die and tap on machine, knurling, drilling, boring, reaming, parting off and grooving. 	Th .08Hours Pract. 120Hours	Mild steel, medium carbon steel, brass.	
	3.3 Perform complex turning operations.	<ul style="list-style-type: none"> ❖ Cut the different kinds of thread by tools, metric, metric fine, BSW, pipe, acme, square, buttress threads (internal/external) ❖ Perform different kind of taper and method of taper turning (external/internal). ❖ Perform eccentric turning. ❖ Perform profile turning. ❖ Perform turning on mandrel. 	Th .15Hours Pract. 150Hours	Mild steel, medium carbon steel, brass.	
4 Explain the safety precautions and procedures	4.1 describe tool and work safety	<ul style="list-style-type: none"> ❖ Handle sharp tools with care. ❖ Store measuring tools separately ❖ Use clean tools, equipment and store as specified. 	Th .03Hours Pract. 01Hours	Computer, Multimedia, White board etc	
	4.2 Understand personal safety.	<ul style="list-style-type: none"> ❖ Wear specified clothes in workshop. ❖ Handle the heavy part carefully. ❖ Keep working space clean from oil and chips. 	Th .02Hours Pract. 01Hours	Computer, Multimedia, White board etc	

Assessment

Module 2: Lathe Operations

Learning Units	Theory Days/hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
Explain the construction of lathe machine, their attachment, accessories and tools	30 hours	10 hours	<ul style="list-style-type: none">❖ Explain the different types of lathe, their attachment, accessories and tools.❖ Explain the clamping devices	Short answer question based test	
Perform the basic mathematical calculations.	25 hours	290 hours	<ul style="list-style-type: none">❖ Explain the cutting speed on lathe❖ Explain and calculate the thread characteristics.❖ Define ISO fit and its kinds.	Short answer question based test	
Perform lathe operations	20 hours	18 hours	<ul style="list-style-type: none">❖ Demonstrate the different lathe operations on a job.	Practical demonstration	
Explain the safety precautions and procedures	05 hours	2 hours	<ul style="list-style-type: none">❖ Explain the personal safety❖ Explain the tool and work safety	Oral questions	

Supportive notes

Assessment Context:-

This unit may be assessed on the job, off the job, or a combination of on and off the job demonstrated by an individual working alone or as part of a team

Critical aspects:-

- Safety precautions.
- Use of cutting fluids.
- Accuracy of dimensions.
- Surface finish.
- Selection of cutting tools, cutting speed and machine RPM.
- Removal of chips formed during operations.

Assessment condition:-

This unit may be assessed separately or in conjunction with other related units. The candidate will have to access all tools, equipment, materials and documentation. The candidate will be permitted to refer any relevant drawings.

The candidate will be required orally or by other methods of communication to answer questions asked by the assessor. Present evidence related to this unit.

Assessors must be satisfied that the candidate can competently and consistently perform all element of the unit as specified by criteria and that he/she possesses the required underpinning knowledge.

Resources required for assessment:-

It includes all tools, equipment and related material listed under considered unit

Module 3 Title: Milling Operations

Objective of the Module: This module covers the competencies required to perform common/complex milling operation and produce commonly used gears such as rack, spur, helical, bevel and other gears ensuring safe working conditions and safe use of tools, equipment material and machinery.

Duration: 400 hours Theory 80 hours Practical 320 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1 Describe the construction of milling machine, their attachment, accessories and tools.	1.1 Explain the construction of milling machine and their uses.	<ul style="list-style-type: none"> ❖ Understand the kinds of milling machine. ❖ Recognized the main parts of milling machine and their uses ❖ Diagnose and rectify the faults. 	Th .08Hours Pract. 04Hours	Milling Machine with accessories	Theory in class room. Practical in related work shop/lab Note: Tool and machinery/ equipment list attached at the end of curriculum Mild steel, medium carbon steel, brass.
	1.2 Understand the attachment of milling machine.	<ul style="list-style-type: none"> ❖ Recognized the main attachment of milling machine. ❖ Mount and remove the attachments and their uses. ❖ Practice on the dividing head for various type of gears 	Th .08Hours Pract. 04Hours	Milling Machine Attachments	
	1.3 Identify the milling tools and their settings.	<ul style="list-style-type: none"> ❖ Select the cutter for required operation. ❖ Apply knowledge of all kinds of cutters and their uses 	Th .04Hours Pract. 02Hours	Various type of milling Cutters	
2 Perform basic Mathematical calculation.	2.1 Apply knowledge of machine calculation.	<ul style="list-style-type: none"> ❖ Calculate cutting speed, RPM and feed. ❖ Calculate and set lead for helical gears. ❖ Calculate the machining time. 	Th .08Hours Pract. 06Hours	Computer, Multimedia, White board etc	

	2.2 Apply knowledge of job calculations	<ul style="list-style-type: none"> ❖ Calculate all kinds of gears characteristics. ❖ Define the gear terminology (DP,CP, Module). ❖ Calculate the direct(simple), indirect(compound), angular and differential indexing. ❖ Perform for gear blank divided into required number of divisions. ❖ Calculate and set gear train for helical gear. 	Th .17Hours Pract. 12Hours	Computer, Multimedia, White board etc, and Milling machine with Dividing Head	
3 Perform milling operations	3.1 Select the tools and clamping device for turning.	<ul style="list-style-type: none"> ❖ Identify the cutter according to job. ❖ Mount and remove arbors for holding the cutters. ❖ Mount the clamping device and clamp the job properly. 	Th .10Hours Pract. 20Hours	Milling Machine Attachments	
	3.2 perform milling operations.	<ul style="list-style-type: none"> ❖ Perform parallel milling. ❖ Perform squaring on milling. ❖ Perform step milling. ❖ Perform slots and key ways milling. ❖ Perform Form and grooving milling. ❖ Perform angular milling. 	Th .18Hours Pract. 120Hours	Mild steel, medium carbon steel, brass.	
	3.3 Perform complex milling operations.	<ul style="list-style-type: none"> ❖ Perform indexing operations (direct, indirect, angular and differential) ❖ Prepare Rack, spur gear, ❖ Perform helical milling (prepare drill, end mill cutter and helical gear) 	Th .12Hours Pract. 150Hours	Mild steel, medium carbon steel, brass.	
4 Understand safety precautions and house keeping	4.1 Describe tool and work safety	<ul style="list-style-type: none"> ❖ Handle sharp tools with care. ❖ Store measuring tools separately ❖ Use clean tools, equipment and store as specified. 	Th .03Hours Pract. 01Hours	Computer, Multimedia, White board etc	
	4.2 Apply personal safety.	<ul style="list-style-type: none"> ❖ Wear specified clothes in workshop. ❖ Handle the heavy part carefully. ❖ Keep working space clean from oil and chips. 	Th .02Hours Pract. 01Hours	Computer, Multimedia, White board etc	

Assessment

Module 3: Milling Operations

Learning Units	Theory Days/ hours	Workplace Days/hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1 Describe the construction of milling machine, their attachment, accessories and tools.	30 hours	10 hours	<ul style="list-style-type: none">❖ Explain the different types of milling machines, their attachments, accessories and tools.❖ Explain the holding/clamping devices	Short answer question based test	
2 Perform basic mathematical calculations	25 hours	290 hours	<ul style="list-style-type: none">❖ Explain the cutting speed on milling.❖ Explain and calculate the spur, helical gear terminology.❖ Explain the type of indexing.	Short answer question based test	
3 Perform milling operations	20 hours	18 hours	<ul style="list-style-type: none">❖ Demonstrate the different milling operations on the job.	Practical demonstration	
4 Understand safety precautions and procedures	05 hours	2 hours	<ul style="list-style-type: none">❖ Explain the personal safety❖ Explain the tool and work safety	Oral questions	

Supportive Notes

Assessment context: -

This unit shall be assessed on the job, off the job or both on / off the job by the candidate working alone or as a part of team.

Critical aspects:-

- Safety precautions
- Accuracy of measurements
- Shape of the machined surfaces
- Smoothness of the machined surface

Assessment condition:-

The candidate will have to access all tools, equipment, machines, material and documentations required.

The candidate will be required to communicate orally or by other methods of communications, to answer the questions asked by the assessor.

Identify superiors who can be approached for the collection of competency evidence where appropriate.

Present evidence related to this unit.

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria.

Resources required for assessment:-

All the tools, equipment, machines and related material listed under the range statement for this unit.

Module 4: Title Perform Turning and Milling Operations by using computer numerical Control (CNC) Lathe and Milling Machines

Objective of the Module: This module covers the competencies required to use computer numerical control (CNC) Lathe and milling machines for different operations and related accessories, ensuring safe working conditions & use of tools, equipment, machinery and material.

Duration: 400 hours Theory 80 hours Practical 320 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
1 Explain the construction of CNC lathe machine, their attachment, accessories and tools	1.1 Explain the constructions of CNC lathe.	<ul style="list-style-type: none"> ❖ Introduction of CNC lathe machine ❖ Describe the advantages and structure of CNC lathe machine ❖ Understand how does CNC work ❖ Explain the coordinate system ❖ Use the operating knobs and keys. 	Th .04Hours Pract. 08Hours	CNC Lathe machine with accessories	Theory in classroom and practical in workshop / lab Note: Tool and machinery/ equipment list attached at the end of curriculum
	1.2 Understand the attachment and accessories of CNC lathe machine.	<ul style="list-style-type: none"> ❖ Introduction of CNC lathe attachments and accessories. ❖ Mount and use the attachments. ❖ Introduction of CNC lathe control panel. ❖ Rotate the turret hand manually. 	Th .04Hours Pract. 08Hours	CNC Lathe machine with accessories and Attachments	
	1.3 Identify the CNC lathe tools and their settings.	<ul style="list-style-type: none"> ❖ Introduction of lathe tool and collets. ❖ Select and clamp the different tools in turret head. ❖ Adjust the presetting device with respect to Job. ❖ Measure and put the value of tools in tool off set geometry. 	Th .02Hours Pract. 04Hours	Turning Tools & Aluminum / Copper	

2 Perform programming for CNC lathe, set the job and tools	2.1 Prepare the machine and tool for job.	<ul style="list-style-type: none"> ❖ Introduction of CNC code ❖ Set the reference points for machine, work piece and tools ❖ Measure the tool data. ❖ Perform programming with tool path. ❖ Calculate the work piece length. 	Th .08Hours Pract. 15Hours	Aluminum / Copper.	
	2.2 Perform programming on CNC lathe.	<ul style="list-style-type: none"> ❖ Write the program compatible to specifications of CAD/CAM. ❖ Check the programme as per given specification by using simulation or dry run. ❖ Edit the programme. 	Th .12Hours Pract. 25Hours	CNC Lathe machine with accessories	
3 Perform on CNC lathe	3.1 Set the machine for operation.	<ul style="list-style-type: none"> ❖ Transfer data from computer to machine. ❖ Clamp the job, tool and set "0" position 	Th .04Hours Pract. 15Hours	CNC Lathe machine with accessories	

	3.2 Perform on lathe machine.	<ul style="list-style-type: none"> ❖ Execute the programme on CNC Lathe ❖ Perform longitudinal turning ❖ Perform Step turning. ❖ Perform Drilling and boring. ❖ Perform Taper turning. ❖ Perform Thread cutting. ❖ Perform Knurling. ❖ Perform Eccentric and profile turning. 	Th .06Hours Pract. 85Hours	Aluminum / Copper.	
4 Understand the construction of CNC milling, their attachment, accessories and tools	4.1 Explain the constructions of CNC milling.	<ul style="list-style-type: none"> ❖ Introduction of CNC Milling machine and safety precaution ❖ Describe the advantage and structure of CNC milling machine ❖ Describe how does CNC work ❖ Explain the coordinate system ❖ Use the operating knobs and keys. 	Th .04Hours Pract. 08Hours	CNC Milling machine with accessories	
	4.2 Use the attachment and accessories of CNC milling machine.	<ul style="list-style-type: none"> ❖ Introduction of CNC milling attachment and accessories ❖ Mount and use the attachment. ❖ Introduce the CNC milling control panel 	Th .04Hours Pract. 08Hours	CNC Milling machine with accessories & Attachments	

	4.3 Identify the CNC milling tools and their settings.	<ul style="list-style-type: none"> ❖ Introduction of milling cutter and collets ❖ Introduction of the clamping device for CNC milling machine. 	Th .02Hours Pract. 04Hours	CNC Milling machine with accessories & Various type of Cutters	
5 Perform programming for CNC milling with setting of job and tools	5.1 prepare the machine and tool for job.	<ul style="list-style-type: none"> ❖ Introduction of CNC code ❖ Select and set the machine reference point. ❖ Clamp the material on machine table ❖ Select and set feed, speed on control panel. 	Th .08Hours Pract. 15Hours	CNC Milling machine with accessories	
	5.2 Perform programming on CNC Milling.	<ul style="list-style-type: none"> ❖ Write the program compatible to specifications of CAD/CAM. ❖ Check the programme as per given specification by using simulation or dry run. ❖ Edit the programme. 	Th .12Hours Pract. 25Hours	CNC Milling machine with accessories	
6 Perform CNC milling	6.1 Set the machine for operation	<ul style="list-style-type: none"> ❖ Transfer data from computer to machine ❖ Select the required cutter for operation ❖ Clamp the job in required clamping device ❖ Clamp the job, tool and set "0" position 	Th .04Hours Pract. 15Hours	CNC Milling machine with accessories	
	6.2 Perform on CNC milling machine	<ul style="list-style-type: none"> ❖ Execute the programme on CNC milling. ❖ Perform Milling flat surface ❖ Perform Milling beveled surfaces ❖ Perform Parting off work pieces ❖ Perform Milling parallel surfaces ❖ Perform Cut the narrow slots and key ways 	Th .06Hours Pract. 85Hours	Aluminum / Copper.	

		❖ Perform Milling spirals			
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Assessment

Module 4: Perform Turning and Milling Operations by using computer numerical Control (CNC) Lathe and Milling Machines

Learning Units	Theory hours	Workplace hours	Recommended formative assessment	Recommended Methodology	Scheduled Dates
1 Explain the construction of CNC lathe machine, their attachment, accessories and tools	10 hours	20 hours	<ul style="list-style-type: none"> ❖ Explain the construction and advantage of CNC machine ❖ Explain the attachment of CNC lathe machine. ❖ Explain the accessories of CNC lathe. 	Short answer questions based test.	
2 Perform programming for CNC lathe, set the job and tools	20 hours	40 hours	<ul style="list-style-type: none"> ❖ Explain the mounting and removing of tool and set "0" point ❖ Explain the mount and setting of work piece ❖ Explain and demonstrate the dry run of program and made correction if required. 	Short questions Short questions and practical demonstration.	
3 Perform on CNC lathe	10 hours	100 hours	<ul style="list-style-type: none"> ❖ Explain the program code and writing of program ❖ Demonstrate the written program as simulation and edit it if required ❖ Explain the method of data transfer ❖ Demonstrate the mounting of job and tool dry run of program on machine and complete the job with different operations. 	Short questions Practical demonstration Short questions Practical demonstration.	
4 Understand the construction of CNC milling, their attachment, accessories and tools	10 hours	20 hours	<ul style="list-style-type: none"> ❖ Explain the construction and advantage of CNC machine ❖ Explain the attachment of CNC milling. ❖ Explain the accessories of CNC milling 	Short answer questions based test.	

5 Perform programming for CNC milling with setting of job and tools	20 hours	40 hours	<ul style="list-style-type: none"> ❖ Explain the program code and writing of program ❖ Demonstrate as per written program as simulation and edit it if required ❖ Explain the method of data transfer. 	Short questions. Short questions. Short questions.	
6 Perform CNC milling	10 hours	100 hours	<ul style="list-style-type: none"> ❖ Explain the program code and writing of program ❖ Demonstrate as per written program as simulation and edit it if required ❖ Explain the method of data transfer ❖ Demonstrate the mounting of job & tool dry run the program on machine and complete the job with different operations. 	Short questions Practical demonstration Short questions Practical demonstration.	

Supportive notes

Assessment context:

This unit shall be assessed or a summative assessment is suitable for this unit.

Critical aspects:-

- Safety precautions
- Accuracy of measurements.
- Surface finish
- Selection of milling cutters.
- Cutting speed and feed.

Assessment condition:-

- The candidate will have to access all tools, equipment, machines, material and documentation required
- The candidate will be permitted to refer to the required documents.
- Relevant workplace procedures.
- Relevant product and manufacturing specifications
- Relevant drawings, manuals, codes, competency evidence where appropriate.
- Present evidence related to this unit.
- Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria and that he/she possesses the required underpinning knowledge and skill. Standards and reference material
- It will be required to orally, or by other methods of communications, answer questions asked by the assessor
- Identify superiors who can be approached for the collection of resources required for assessment, all the tools, equipment, machines and related material listed to typical workplace activities.

Resources required for assessment:-

All the tools, equipment, machines and related material listed under the range statement for this unit.

List of Machinery / Equipment / Tools

(For a Class of 25 Students)

Name of Trade	Mechanical Machinist
Duration of Course	One – year

Sr. No.	Nomenclature of tools & equipment	Quantity
1.	Universal milling machine	10 Nos.
2.	Lathe machine size 03 feet	06 Nos.
3.	Lathe machine size 06 feet with gap bed	10 Nos.
4.	Power Hacksaw	02 Nos.
5.	Shaper machine	08 Nos.
6.	Radial drill machine	02 Nos.
7.	Bench drill machine	02 Nos.
8.	CNC Lathe Machine with 05 work station	02 Nos.
9.	CNC Milling Machine with 05 work station	02 Nos.
10.	Computer	25 Nos.
11.	Computer (server)	01 No
12.	Multimedia with screen	02 Nos.
13.	Printer	02 Nos.
14.	Scanner	01 No
15.	Surface grinding machine	02 Nos.
16.	Cylindrical grinding machine	02 Nos.
17.	Pedestal grinding machine	04 Nos.
18.	Bench vice with bench	25 Nos.
19.	Steel rule	25 Nos.
20.	Vernier caliper	25 Nos.
21.	Vernier height gauge	02 Nos.
22.	Vee block	04 Nos.
23.	Centre punch	25 Nos.
24.	Scriber	25 Nos.
25.	Divider	25 Nos.
26.	Screw driver set	6 set
27.	Philips type screw driver set	6 set
28.	Taps set M4,M5,M6,M8,M10,M12	4 each size
29.	Tap handle set	4 set
30.	Screw pitch gauge 60°	4 set
31.	Screw pitch gauge 55°	4 set
32.	Radius gauge 1-7,7.5-14mm	4 Nos.

33.	Combination set	4 Nos.
34.	Allen key set 1mm TO 10mm	4 set
35.	Double ended open spanner set 6-32mm	4 set
36.	Ring spanner set 6-32mm	4 set
37.	Ball peen hammer 500 gm	25 Nos.
38.	Cross peen hammer 500 gm	25 Nos.
39.	Marking hammer 250 gm	6 Nos.
40.	Number punch set	4 set
41.	Letter punch set	4 set
42.	Flat file 300 x1	25 Nos.
43.	Flat file 300x2	25 Nos.
44.	Flat file 250x2	25 Nos.
45.	Flat file 250x3	25 Nos.
46.	Flat file 150x1	25 Nos.
47.	Flat file 150x2	25 Nos.
48.	Half round file 200x2	25 Nos.
49.	Half round file 200x1	25 Nos.
50.	Round file 200x1	25 Nos.
51.	Round file 200x2	25 Nos.
52.	Round file 150x2	25 Nos.
53.	Round file 150x1	25 Nos.
54.	Needle file set	25 Nos.
55.	Key file set	25 Nos.
56.	File brush	25 Nos.
57.	Flat chisel	25 Nos.
58.	Cross cut chisel	25 Nos.
59.	Grooving chisel	25 Nos.
60.	Hand reamer 4H7,6H7,8H7,10H7, 12H7,14H7	6 sets

61.	Die M5, M6, M8, M10, M12	6 sets
62.	Dies handles	6 sets
63.	Drills 3.0, 3.8, 4, 4.2,4. 8,5.0,5.5,6.0,6.5,7. 0,7.5,8.0,8.2,8.5,9.0,9.5,10.0,10.2,10.5, 5.0,12mm	10 sets
64.	Drill set 1 to 10 mm with difference 0.1 mm	12 set
65.	Centre drill 2.5, 3.0 mm	12 set
66.	H.S.S tool bits 8x8x160 mm	200 Nos.
67.	H.S.S tool bits 12x12x200mm	200 Nos.
68.	H.S.S tool bits 16x16x200 mm	200 Nos.
69.	Morse taper gauge set (plug + ring) MT-2, MT-3, MT-4	One each.
70.	Oil cane	25 Nos.
71.	Tool centre gauge 55° and 60°	6 Nos.
72.	Hand vice	8 Nos.

73.	Adjustable wrench 12"	6 Nos.
74.	Try angle file 200x2	25 Nos.
75.	Try angle file 200x1	25 Nos.
76.	Counter sink 18; x60°, 12.5x60°	08 sets
77.	Counter bore M 4, M 6, M 10, M 12	06 sets
78.	Twist drill grinding gauge	06 Nos.
79.	Safety goggle	25 Nos.
80.	Diamond dresser with holder	04 Nos.
81.	Acme thread gauge	06 Nos.
82.	Drill drift	06 Nos.
83.	Combination pliers	06 Nos.
84.	Tool box	25 Nos.
85.	Surface plate	3 Nos.
86.	Plain milling cutter ϕ 100x50x27	08 Nos.
87.	Plain milling cutter ϕ 63x50x22 mm	08 Nos.
88.	Plain milling cutter ϕ 63x25x27 mm	08 Nos.
89.	Side and face cutter ϕ 80x8x27 mm	08 Nos.
90.	Side ϕ 80x12x27 and face cutter ϕ 80x14x27 mm	08 Nos.
91.	Side and face cutter ϕ 80x18x27	08 Nos.
92.	End mill cutter ϕ 4 mm two lipped	12 Nos.
93.	End mill cutter ϕ 5 mm two lipped	12 Nos.

94.	End mill cutter ϕ 6 mm two lipped	12 Nos.
95.	End mill cutter ϕ 8 mm two lip/four lip	12 Nos.
96.	End mill cutter ϕ 10 mm	12 Nos.
97.	End mill cutter ϕ 12 mm	12 Nos.
98.	End mill cutter ϕ 14 mm	12 Nos.
99.	End mill cutter ϕ 16 mm	12 Nos.
100.	End mill cutter ϕ 18 mm	12 Nos.
101.	Involute gear milling cutter module 1.0 mm	03 Nos.
102.	Involute gear milling cutter module 1.5 mm	03 Nos.
103.	Involute gear milling cutter module 1.75 mm	03 Nos.
104.	Involute gear milling cutter module 2.0 mm	03 Nos.
105.	Convex cutter r6x80 mm	03 Nos.
106.	Convex cutter r8x80 mm	03 Nos.
107.	Convex cutter r12x80 mm	03 Nos.
108.	Micro meter 25 mm	04 Nos.
109.	Micro meter 25-50mm	04 Nos.
110.	Micro meter 50-75mm	04 Nos.
111.	Inside micro meter 5-55 mm	04 Nos.
112.	Dial vernier calipers	04 Nos.

113.	Dial indicator with magnetic stand	04 Nos.
114.	Digital vernier calipers 160mm	04 Nos.
115.	Digital micro meter 0-25 mm	04 Nos.
116.	Digital micro meter 25-50 mm	04 Nos.

CNC Milling Machine

Vertical Spindle

CNC Programming and simulation software control on computer (6-Work stations)

CNC vertical spindle milling machine with manual control & programming (02 Nos.)

Spindle Drive system

- Spindle speed, (31.5-3150 rpm)
- Spindle taper(ST-standard taper)
- Power tool clamping unit (switch- operator)

Feed Drive System

- Separate DC Machine motors and ball screws in all axes
- Feed rates, programmable 2-3600 mm/min.
- Rapid traverse rate X/Y/Z 4000 MM/MIN
- Electronic hand wheel input resolution per scale
- Division (selectable) mm

Range of Traverse

- X (right / left) 300 mm
- Y (forward / back) 300 mm
- Z (up / down) 400 mm

CNC Lathe Machine

EMCO PC turn 125 with complete accessories (02 Nos.)

Accessories Details:-

- Cutting tips internal with tip holders
- Cutting tips external with tip holders
- Drill set
- Collets etc.
- Software Description (EMCO educational concept on PC Basis)
- EMCO Win NC
- GE Fanuc series O-TC
- Workstation on PC (13 Nos.)

Note: - The CNC Machines may be installed in dust free and temperature controlled room / Lab.

Reference Books

Practical

Sr. No.	Title of the book	<i>T.T.P Series No.</i>	<i>Published by</i>
1.	Trade training – i	T.T.P series – 24	Development cell Lahore
2.	Trade training – ii Turner	T.T.P series – 25	-
3.	Trade training – ii Machinist	T.T.P series – 25	-
4.	Trainee manual machinist g – iii	-	National training board Islamabad

Theory

Sr. No.	Title of the book	<i>T.T.P series no.</i>	<i>Published by</i>
1.	All about machine tools	T.T.P series – 2	Translated by Aftab ahmed ttc mughalpura lahore
2.	Technical mathematics	T.T.P series – 1	-
3.	metals	T.T.P series – 50a	-
4.	Basic metal work	T.T.P series – 50	Translated by Aftab Ahmed A.G. Minhas
5.	Technical drawing – i	T.T.P.7	
6.	Technical drawing – ii	T.T.P.8	

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