







© TVET RSP

MACHINIST

CBT Curriculum

National Vocational Certificate Level 2-4

Version 1 - August 2019



Published by

National Vocational and Technical Training Commission Government of Pakistan

Headquarter

Plot 38, Kirthar Road, Sector H-9/4, Islamabad, Pakistan www.navttc.org

Responsible

Director General Skills Standard and Curricula, National Vocational and Technical Training Commission National Deputy Head, TVET Sector Support Programme, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Layout & design SAP Communications

Photo Credits TVET Sector Support Programme

URL links

Responsibility for the content of external websites linked in this publication always lies with their respective publishers. TVET Sector Support Programme expressly dissociates itself from such content.

This document has been produced with the technical assistance of the TVET Sector Support Programme, which is funded by the European Union, the Federal Republic of Germany and the Royal Norwegian Embassy and has been commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in close collaboration with the National Vocational and Technical Training Commission (NAVTTC) as well as provincial Technical Education and Vocational Training Authorities (TEVTAs), Punjab Vocational Training Council (PVTC), Qualification Awarding Bodies (QABs)s and private sector organizations.

Document Version August, 2019 Islamabad, Pakistan © TVET RSP

MACHINIST

CBT Curriculum

National Vocational Certificate Level 2-4 Version 1 - August 2019

Table of Contents

1.	Introduction	4
2.	Overview of the curriculum for Machinist	14
3.	Machinist curriculum contents (Teaching & Learning guide)	
	3.1 Module 1: Demonstrate Communication Skills	15
	3.2 Module 2: Maintain Safe Work Environment	18
	3.3 Module 3: Carry out Calculations and Prepare Estimates	21
	3.4 Module 4: Carry out Bench Work	24
	3.5 Module 5: Carryout General Maintenance	31
	3.6 Module 6: Perform Grinding Operations	36
	3.7 Module 7: Perform Shaping Operations.	45
	3.8 Module 8: Perform Turning Operations	50
	3.9 Module 9: Perform Milling Operations	64
	3.10 Generate Gear	75

3.11 Develop Drawing and Design	81
3.12 Maintain CNC Machines and Tools	84
3.13 Perform CNC Lathe Operations	87
3.14 Perform CNC Milling Operations	94
3.15 Perform CNC EDM Wire Cut Operations	101

List of tools and equipment

INTRODUCTION

A machinist is a multidimensional tradesperson specialized in machine shop machines and related cutting and measuring tool equipment or the maintenance and repair of existing machines infrastructure.

In order to meet the demand for machine shop, National Vocational and Technical Training Commission (NAVTTC) in collaboration with TVET Sector Support Programme (TVET-SSP) have developed national vocational qualifications comprising of generic, functional and technical competency standards for a machinist occupation.

To facilitate the process of developing national qualifications for machinist, a Qualification Development Committee (QDC) was established under NVQF Operational Manual-1.

Competency standards, which are benchmarks for the performance, cover both the domestic and commercial aspects of an machinist's job. While setting the standards for the performances, required skills, underpinning knowledge and attitudes expected of a machinist have been inculcated in these competency standards.

Sector Skills Council (SSC) for Construction and experts from related industries have thoroughly reviewed and validated the competency standards as proposed by the QDC in terms of their relevancy and currency to the requirement of the job. The validated competency standards will provide the basis for further curricula, assessment materials and instructional materials development that will support competency based training and assessment activities.

The training program shall be organized in an institute where the Machinist labs are available for trainees.

Definition/ Description of the training program (Machinist)

- The training programme shall be organized in an institute that trains the trainees to work base situation in Machinist Trade.
- The training programme enable the student to pursue the Demonstrate Communication Skills
- The training programme enable the student to pursue the Maintain Safe Work Environment and Carryout General Maintenance
- The training program shall enable the student to pursue a Machinist career path with greater employment skills
- The training program shall give the opportunity to become entrepreneur in machinist field.
- The training program will be more effective and beneficial who may already have experience or knowledge of basic machine shop.
- The training program will be also being beneficial for them who want to focus on only one area and make their future in the same field

- The training program shall be good guidance on inside tips and tricks on techniques like bench work, drilling, lathe work, milling work, grinding work and CNC milling /lathe and EDM Wire Cut Machine work etc.
- The training program shall be more focused that how to finalize the workpiece on shaper bench work / drilling /grinding machines lathe/ milling machine/ Hobbing and CNC Machine (Lathe / Milling/ Wire Cute Machines).
- This training programme will be more creative on how to create special workpiece on CNC milling/lathe.

PURPOSE OF THE QUALIFICATION

The purpose of this training is to develop a range of skills and techniques, personal skills and attributes essential for successful performance in machinist in accordance with industry requirements. It also enables the student to pursue a machinist career path with greater employment and entrepreneurial skills progress to related general and/or vocational qualifications.

- Improve the overall quality of training delivery and setting national benchmarks for training of Machinists in the country.
- Provide flexible pathways and progressions to learners enabling them to receive relevant and current skills set
- Provide basis for competency based assessment which is recognized and accepted by employers.
- Establish a standardized and sustainable system of training for Machinists in the country

Overall objectives of the training program

Following are the main objectives of the training program:

- To produce a capable & skillful workforce as required by the prevailing market demands
- To produce work safely, effectively and hygienically
- To develop characteristics among the trainees such as self-reliance, reliability, responsibility and ability to lead the program in the field
- To give competency in the field of machinist and its associated elements
- To develop excellent workpiece on milling, lathe, shaper and CNC machines.
- To develop ability among the trainees to work in a team environment
- To develop knowledge of sterilization and sanitation rules and explain their importance
- To define personal and public hygiene & demonstrate good grooming principles

Possible available job opportunities available immediately and later in the future

- Fertilizer plants.
- Engineering industry
- 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

1.2 Entry level of trainees

• Middle

Minimum Qualification of trainer

- Should have completed intermediate and equivalent qualifications
- Must be a holder of G-II Machinist certificate or Three years DAE in Mechanical.
- Must be able to communicate effectively both orally and in written form
- Must have at least two (4) years teaching experience.

Recommended trainer: trainee ratio

1: 20

Medium of instruction

Urdu, local language

Sequence of the modules

Code	Competency Standards	(Level-)	(Level-)	(Level-)	(Level-)
	Demonstrate Communication Skills				
	Maintain Safe Work Environment				
	Carry out Calculations and Prepare Estimates				
	Carry out Bench Work				
	Carryout General Maintenance				
	Perform Grinding Operations				
	Perform Shaping Operations				
	Perform Turning Operations				
	Perform Milling Operations				
	Generate Gear				
	Develop Drawing and Design				

Maintain (and Tools	CNC Machines		
Perform C Operation	SNC Lathe		
Perform C Operation	NC Milling s		
Perform C Cut Opera	NC EDM Wire ations		

SUMMARY TEMPLATE – OVERVIEW OF THE CURRICULUM

Module Title and Aim	Learning Units	Theory ¹ Days/hours	Workplace ² Days/hours	Timeframe of modules
Module 1:	LU-1: Work in Team	01 hours	06 hours	07 hours
Demonstrate Communication Skills	LU-2: Deal with Clients	01 hours	06 hours	07 hours
	LU-3: Demonstrate Basic IT Skills	02 hours	14 hours	16 hours
Aim:				
Be able to verbal and written				
communication dealing with client work				
on computer.				
Module 2: Maintain Safe Work	LU-1: Identify Hazards at Workplace	03 hours	12 hours	15 hours
Environment	LU-2: Observe Occupational Safety and Health (OSH)	03 hours	12 hours	15 hours
Aim:				
Be able to consider and follow				
Occupational Health & Safety				
Procedures at Workplace				
Module 3:	LU-1: Develop Basic Mechanical Drawing	03 hours	17 hours	20 hours
Carry out Calculations and Prepare	LU-2: Perform Estimation of Materials	03 hours	07 hours	10 hours
Estimates for Mechanical Work	LU-3: Prepare Costing for the Work	03 hours	07 hours	10 hours

Aim: Be able to prepare mechanical drawing estimations and costing of work.				
Module 4: Carry out Bench Work Aim: Be able to perform sawing, filling, threading (internal and external) reaming operations.	LU-1: Carry-Out Sawing LU-2: File the Workpiece LU-3: Carry-Out Drilling LU-4: Produce Threads on workpiece LU-5: Perform Hand Reaming	02hours 03 hours 03 hours 04 hours 03 hours 15	15 hours 30 hours 30 hours 30 hours 30hours	17 hours 33 hours 33 hours 34 hours 33 hours
Module 5: Carryout General Maintenance Aim: Be able to consider and follow preventive maintenance of tools' and machines' housekeeping.	 LU-1: Perform General Housekeeping & Maintenance LU-2: Perform Preventive Maintenance LU-3: Perform Maintenance of Tooling 	02 hours 02 hours 02 hours	08 hours 08 hours 08 hours	10 hours 10 hours 10 hours
Module 6:Perform Grinding OperationsAim:Be able to perform grinding of jobs(Off-hand, surface grinding, cylindricalgrinding and tool/cutter grinding).	LU-1: Perform Off-Hand Grinding LU-2: Perform Surface Grinding LU-3: Perform Cylindrical Grinding LU-4: Perform Tool/Cutter Grinding LU-5: Perform Centreless Grinding	02 hours 03 hours 04 hours 04 hours 02hours	20 hours 30 hours 35 hours 35 hours 15hours	22 hours 33 hours 39 hours 39 hours 17 hours

Module 7:	LU-1: Prepare Materials for Shaping Operations	01 hours	02 hours	03 hours
Perform Shaping Operations	LU-2: Select Tools and Equipment	01hours	02 hours	03 hours
	LU-3: Set Shaper Machine for Operations	01hours	02 hours	03 hours
Aim:	LU-4: Perform Shaping Operations (Square Job)	01hours	09 hours	10 hours
Be able to machine the job by setting and controlling shaping machine tool according to the requirements.	LU-5: Perform Shaping Operations (Angular Job)	01hours	10 hours	11 hours
Module 8:	LU-1: Prepare Materials for Lathe Operations	02 hours	04 hours	06 hours
Perform Turning Operations	LU-2: Select Tools and Equipment	02 hours	04 hours	06 hours
0	LU-3: Set Lathe Machine for Operations	02 hours	04 hours	06 hours
Aim:	LU-4: Carry-Out Lathe Operations	08 hours	334 hours	342 hours
Be able to Prepare materials and perform all common and complex. Lathe operation using conventional lathe machine.				
Module 9:	LU-1: Prepare Materials for Milling Operations	02 hours	04 hours	06 hours
Perform Milling Operations	LU-2: Select Tools and Equipment	02 hours	04 hours	06 hours
	LU-3: Set Milling Machine for Operations	02 hours	04 hours	06 hours
Aim:	LU-4: Carry-Out Milling Operations	08 hours	334 hours	342 hours
Be able to Prepare materials and perform all common and complex milling operation and produce commonly used square, slotting, drilling, boring and gears.				
Module 10:	LU-1: Prepare Blank for Generating the Gear	02 hours	18 hours	20 hours
Generate Gear	LU-2: Select Tools and Equipment for Gear	02 hours	04 hours	06 hours
	Cutting	02 hours	04 hours	06 hours
Aim:	LU-3: Set Hobbing Machine for Operations	02 hours	166 hours	168 hours

Be able to Prepare gear blank and	LU-4: Carry out Hobbing Operations for Gear			
perform all gear on hobbing machines.	Generating			
Module 11:	LU-1: Develop 2D Sketch /Drawings	04 hours	86 hours	90 hours
Develop Drawing and Design	LU-2: Develop 3D Models	06 hours	104 hours	110 hours
Aim:				
Be able to develop 2D sketch				
/drawings and develop 3D models				
Module 12:	LU-1: Maintain proper fluid levels	02 hours	04 hours	06 hours
Maintain CNC Machines and Tools	LU-2: Change machine oil /coolant	02 hours	04 hours	06 hours
	LU-3: Maintain cutting tools	02 hours	06 hours	08 hours
Aim:				
Be able to set & maintain computer				
numerical control (CNC) machine and tools				
loois				
Module 13:	LU-1: Mount the job	02 hours	04 hours	06 hours
Perform CNC Lathe Operations	LU-2: Generate the program	02 hours	04 hours	06 hours
	LU-3: Run simulation	02 hours	04 hours	06 hours
Aim:	LU-4: Feed the program	02 hours	04 hours	06 hours
Be able to set & perform on computer	LU-5: Perform CNC Lathe Operations	08 hours	118 hours	126 hours
numerical control (CNC) Lathe machine				
machine				
Module 14:	LU-1: Mount the job on Milling Machine	02 hours	04 hours	06 hours
Perform CNC Milling Operations	LU-2: Generate the program for CNC Milling	02 hours	04 hours	06 hours
	LU-3: Run simulation	02 hours	04 hours	06 hours
Aim:	LU-4: Feed the program into CNC Milling	02 hours	04 hours	06 hours
	LU-5: Perform CNC Milling Operations	08 hours	118 hours	126 hours

Be able to set & perform on computer numerical control (CNC) milling machine				
Module 15: Perform CNC EDM Wire Cut Operations Aim: Be able to set & perform on computer numerical control (CNC) EDM Wire Cut machine	LU-1: Mount the job on EDM Wire Cut Machine	02 hours	04 hours	06 hours
	LU-2: Generate the program	02 hours	04 hours	06 hours
	LU-3: Run simulation	02 hours	04 hours	06 hours
	LU-4: Feed the program	02 hours	04 hours	06 hours
	LU-5: Perform CNC EDM Wire-cut Operations	08 hours	88 hours	96 hours

Module: 1 Module Title: Demonstrate Communication Skills Objective of the Module:

This module identifies the competencies required to apply communications skills in accordance with the organization's guidelines and procedures. You are expected to work in a team to achieve common organizational goals and avoid conflicts. This competency standard would also enable you to use basic computer skills to communicate effectively and prepare work related documents.

Duration:						
Total Time:	30 hours	Theory:	04 hours	Practical:	26 hours	

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Work in Team	 Trainee should be able to: Treat team members with respect and maintain positive relationships to achieve common organizational goals. Listen instructions carefully & follow as required. Provide work related information to team members and identify interrelated work activities to avoid confusion. 	 Principles of effective and interactive communication. 7 C's of communication and their importance. Cultural and organizational practices for effective communication. Role of team members and functionality of work teams. Team dynamics and stages of team development. 	Total: 07 hours Theory: 01 hours Practical: 06 hours		Theory: Class room Practical: Lab/ workshop

	 Adopt communication skills appropriate to work activities and company procedures. Identify problems and resolve them through discussion and mutual agreement. 			
LU-2: Deal with Clients	 Trainee must be able to: Collect and confirm work requirements from clients using appropriate communication procedures. Provide clear information to clients about work requirements including costs and time needed to accomplish the task. Negotiate with clients regarding wages, time, labour requirements etc. 	 Effective negotiation skills. Conflict resolution strategies. Negotiation techniques. 	Total: 07 hours Theory: 01 hours Practical: 06 hours	Theory: Class room Practical: Lab/ workshop
LU-3: Demonstrate Basic IT Skills	 Trainee should be able to: Create folders and files and learn major commands of operating system/windows. Type text and use major commands such as printing, editing, creating tables, header footer, footnotes, table of contents and page number etc. 	 Knowledge of Basic architecture of computer system. Input / output devices of computer and their functions Basic computer skills using MS Word, MS Excel, use of internet, sending and receiving emails etc. Preparing documents and work related reports. 	Total: 16 hours Theory: 02 hours Practical: 14 hours	Theory: Class room Practical: Lab/ workshop

•	Make the document as per	Practical Activity:	
•	 work specifications and client's requirement. Generate reports for clients as required using appropriate computer applications. Use internet for sending/receiving emails and connecting through social or 	 Preparing documents in MS Word and MS Excel 	
	other media.		

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 2 Module Title: Maintain Safe Work Environment Objective of the Module:

This module identifies the competencies required to apply occupational safety and health at workplace in accordance with the organization's approved guidelines and procedures. You will be expected to identify and use Personnel Protective Equipment (PPE) according to the job requirement and potential hazards at workplace. The underpinning knowledge regarding OSH will be sufficient to provide the basis for your work.

Duration:					
Total Time:	30 hours	Theory:	06 hours	Practical:	24 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Identify Hazards at Workplace	 Trainee should be able to: Read and interpret work processes and procedures correctly to identify risk of hazards at workplace. Recognize engineering processes, tools, equipment and consumable materials that have the potential to cause harm. Identify any potential hazards and take appropriate action to minimize the risk. 	 Understand drawing and engineering processes and procedures correctly Knowledge of techniques and methods to identify the risks and potential hazards at workplace. Knowledge ofpotential hazards andappropriate action to be taken to minimize the risk. Adopt health and safety precautions of -workplace. (Worksite Hazardous Materials Information Systems (WHMIS), fire regulations,_Material 	Total: 15 hours Theory: 03_hrs. Practical: 12 hours	Health and safety manuals. Machine Installation manual Fire extinguisher Overall	Theory: Class room Practical: Lab/ workshop

LU-2:	Trainee must be able to:	 Safety Data Sheet – MSDS. Knowledge and understanding of hazards to avoid accident or injury at workplace. Prepare check list for safety precautions to avoid hazards. Knowledge of accident reports, reporting procedures and documentation. 	Total:	Maintenance Box Safety	Theory:
LU-2: Observe Occupational Safety and Health (OSH)	 Work safely at all times, complying with health and safety precautions, regulations and other relevant guidelines. Identify health and safety hazards in the workplace, so that the potential for personal injury, damage to equipment or the workplace is prevented, and corrective action is taken. Deal with problems which are within your control, and report those that cannot be resolved to safety officer. Wear, adjust, and maintain personal protective equipment to ensure correct fit and optimum protection in compliance with company procedures. 	 Identify the Types of hazards that are most likely to cause harm to health and safety. Knowledge of Health and safety precautions. Interpret Health and safety signs Understand_Techniques and methods to identify hazards and minimize the risk at workplace. Understand emergency procedures to deal with any accident or injury. Following 5S and Kaizen Activities Safety reporting procedures and documentation. Use of Personal Protective Equipment. First aid treatment methods including Cardiac Pulmonary resuscitation CPR understanding_Fire-fighting methods 	15 hours Theory: 03 hours Practical: 12 hours	Safety equipment, Safety shoes, Safety gloves Safety goggles Safety helmet Ear plugs Smoke detecting alarm	Class room Practical: Lab/ workshop

Keep work area clear		of handling heavy	First aid box
clear of obstructions storing tools or equi that the potential for or injury is prevente	oment, so accident		Dust Mask Overall

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 3 Module Title: Carry out Calculations and Prepare Estimates Objective of the Module:

This module identifies the competencies required to prepare estimates in accordance with client's guidelines. You will be expected to estimate, ensuring cost effectiveness, conforming to standards and regulations. The underpinning knowledge regarding calculations and estimation will be sufficient to provide the basis for your work.

Duration:					
Total Time:	40 hours	Theory:	09 hours	Practical:	31 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Develop Basic Mechanical Drawing	 Trainee should be able to: Take accurate measurements and collect information regarding work specifications. Develop drawing according to the job requirement. Confirm the job specifications, material(s) and drawing from client or supervisor and make necessary adjustments, where required. 	 Basic mechanical terminologies including RPM, cutting speed, feed etc. Use of measuring and marking tools. Mathematical calculations used in machining. Basic mathematical formulas & numerical solving skills. Interpretation of layout plans/diagrams, service manuals₁ manufacturer's specifications, technical drawings, drawing symbols and drawing standards etc. 	Total: 13hrs. Theory: 03hrs. Practical: 10 hrs.	Drafting tables, T- Squares and Set-squares Drawing sheets , (, A3 and A4,-) Geometry box with pencil, rubber,	Theory: Class room Practical: Lab/ Workshop <u>/</u> Drawing hall

	-	 Preparing 2D drawing (orthographic views) using manual techniques. Practical Activity: Preparing 2D drawing manually for milling and turning job. 	-	sharpener, eraser_circle templates and rule scotch tape	
LU-2: Perform Estimation of Materials	 Trainee must be able to: Identify requirements of the material(s) to be utilized for the work in accordance with the job specifications and drawing. Check and confirm the requirement of the materials from the client or supervisor for accurate estimation. Quantify the material as per drawing. Use appropriate methods of calculation of cost of material and accessories keeping in view the current market prices. Check and present the cost estimate to the client or supervisor for agreement. Make necessary adjustments in estimates, where required. 	 Common Types of materials used in machinist work and their costing. Norms and standard formats of preparing estimates Record keeping and reporting Knowledge of current market prices of materials and accessories to calculate the job costs. Norms in interacting & negotiating with customers/clients. Practical Activity: Calculate the material cast for milling and turning job. 	Total: 50hrs. Theory: Practical:	Measuring instruments and marking tools Scientific calculator	Theory: Class room Practical: Lab/ workshop

LU-3: Prepare Costing for	 Trainee should be able to: Calculate man-hours and machine-hours for work in accordance with the job 	 Method of calculating labour costs/overheads/profit margin etc. Record keeping and reporting 	Total: Theory:	Scientific calculator	Theory: Class room Practical:
the Work	 requirements. Prepare labour cost for the work using appropriate procedures. 	 Practical Activity: Calculate the material, man-hours and machine-hours cast for milling and turning job. 	Practical:		Lab/ workshop

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 4 Module Title: Carry out Bench Work

Objective of the Module:

This module identifies the competencies you need to perform bench work operations using different tools and equipment, in accordance with approved procedures. You will be expected to perform sawing, filing, threading and reaming using hand tools. You will be required to operate the tools and equipment safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:						
Total Time:	150 hours	Theory:	15 hours	Practical:	135 hours	

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Carry-Out Sawing	 Trainee should be able to: Select appropriate blade and set in hacksaw frame according to the job requirement. Select appropriate marking tool(s), mark the workpiece and clamp it in the vice firmly as per standard practices. Adopt sawing methods and techniques that are safe and 	 Personal protective equipment (PPEs) and workplace safety Mechanical Properties and strength of materials Interpret basic drawings Method and use of Measurement systems Understand and use of marking tools Knowledge of types of Hacksaw blade and Hacksaw frame. Usage of bench working tools Perform sawing with hand hacksaw. 	17hrs. Theory: 02hrs.	Hand hacksaws with blades, complete sets (assorted range) with standard accessories Bench vices	Theory: Class room Practical: Lab/ workshop

	 suitable to produce the workpiece as needed. Follow marked line during sawing of workpiece to ensure accuracy. 	 importance of clamping of work piece Procedure of safe clamping of the workpiece for sawing. Practical Activity: Mark the flat workpiece for three sawing and cut with Hand hacksaw as per drawing. (adopt safety method) 		Work bench and stools Measuring and marking tools PPEs	
LU-2: File the Workpiece	 Trainee must be able to: Select appropriate file and marking tool(s) according to the job requirement. Mark the workpiece and clamp it in the vice firmly as per standard practices. Adopt filing method and technique which is safe and suitable to produce the workpiece as needed. Follow drawing dimensions and surface finish of filed workpiece to ensure accuracy and precision. 	 Personal protective equipment (PPEs) and workplace safety. Knowledge and adopting safe techniques for all kinds of files. Method of marking as per drawing for filling. Procedure of safe clamping the workpiece for filling. Usage of bench work tools and equipment Interpret basic drawings with respect to surface finish and tolerance of filed workpiece to ensure accuracy and precision. Perform different filling operation ie. parallel filling, curved edge, even surface and square filling. Profile filling of keyways with needle file set 	Total: 33 hrs. Theory: 03 hrs. Practical: 33 hrs.	Bench vices Work bench and stools Measuring and marking tools All kind of Files (assorted range) Needle file set	Theory: Class room Practical: Lab/ workshop

		 Perform clamping of workpiece as required. Understand and use of measuring tools importance of safety precaution. Knowledge of e disposal of the waste material after bench work Practical Activity: File the rectangle workpiece with flat file (rough and smooth for finishing) as per given sizes. (adopt safety method) 			
LU-3:	Trainee should be able to:		Total:		Theory:
Carry-Out Drilling	 Setup drill machine for producing hole in the workpiece according to the job requirement. Select drill bit and marking tools according to the material and job requirement, respectively. Mark the workpiece according to the drawing and clamp it in the vice firmly as per standard practices. Adopt proper drilling method (manual/auto-feed, applying coolants) which is safe and 	 Personal protective equipment (PPEs) and workplace safety Understand the construction of different types of drill machines. Knowledge of different type of drill machines and their functions. Calculate cutting speed, feed and RPM on drilling machine Method of marking as per drawing for drilling and center punch at drill point. 	33 hrs. Theory: 03 hrs. Practical: 30 hrs.	Machine vices Pillar drilling machines Drill chuck with Key Drill bits (assorted range) Center drills (assorted range)	Class room Practical: Lab/ workshop

LU-4:	 Trainee should be able to: Select tap and die according to the type of thread to be 	 Personal protective equipment (PPEs) and workplace safety 	Total: 24 hrs.	Machine vices_and bench vice	Theory: Class room
		 Mark and Centre punch the filled rectangle workpiece and drill for internal thread and reaming. (adopt safety method) Perform counter-boring and counter- sinking operation on the workpiece according to the drawing 			
		Practical Activity:			
	and precision.	 drilled workpiece to ensure accuracy and precision. Usage of measuring tools as per drawing requirement. Types of Drills with respect to drill materials, type of shanks, etc. Nomenclature of drill bits Drilling operations (Counter-boring, counter-sinking, spot facing and machine reaming) Types and functions of coolants 			
	suitable to produce the hole in workpiece.Follow drawing dimensions of drilled hole to ensure accuracy	 Procedure of safe clamping the workpiece for drilling. Interpret basic drawings with respect to surface finish and tolerance of 		Measuring and marking tools	

Produce	produced on workpiece as per	• Knowledge of different types of	Theory:		Practical:
Threads on	drawing.Clamp the workpiece in the	threads.	04 hrs.	Pillar drilling machines	Lab/
workpiece	clamping device firmly as per	Knowledge and usage of safe	Practical:	maonines	workshop
	standard practices.Ensure the tap and die	techniques for Threading.	20 hrs.	Drill chuck with Key	
	alignment as per prescribed	Knowledge of different kind of taps &		Drill bits	
	standard.Make thread with die and	dies_according to requirement		(assorted	
	follow appropriate sequence in	Knowledge of calculation of drill size		range)	
	case of using tapsEnsure the safety and	for internal threading_(Tapping).		Measuring	
	dimensional accuracy of	•		and marking	
	threads on workpiece as per drawing.	Perform manual_threading_by using		tools	
	drawing.	dies and taps		Dies and	
		 Ensure tap and die alignment. 		Taps Set with handle	
		Ensure use of lubricants during		(assorted	
		threading.		range)	
		 Knowledge of threading procedure for producing_accurate and dimensionally correct threads. 		Thread Plug gauge and thread Ring gauge	
		• Method of marking as per drawing for internal threading and center punch		(assorted range)	
		at drill point.		State cutting oil	

		 Procedure of safe clamping the workpiece for internal/external threading. usage of measuring tools (thread plug_gauge and thread ring gauge) as per_drawing requirement. Practical Activity: Internal threading on drilled hole workpiece as per drawing. (adopt safety method) Produce external thread on shaft as per drawing. (adopt safety method) 			
LU-5: Perform Hand Reaming	 Trainee should be able to: Select reamer according to the workpiece requirement. Clamp the workpiece in the clamping device firmly as per standard practices. Ensure the reamer alignment as prescribed standard. Produce reamed hole by following safety and prescribed method. Ensure the accuracy and size of reamed hole of workpiece according to the drawing. 	 Personal protective equipment (PPEs) and workplace safety Knowledge and usage of safe techniques for Hand Reaming. Knowledge of different kind of reamersaccording to requirement Knowledge of calculation of drill size for reaming Method of marking as per drawing for Hand Reaming and center punch at drill point. 	Total: 33 hrs. Theory: 03 hrs. Practical: 30 hrs.	Machine vices Pillar drilling machines Drill chuck with Key Drill bits (assorted range)	Theory: Class room Practical: Lab/ workshop

 Procedure of safe clamping the workpiece for Hand Reaming. Interpret basic drawings dimensions and surface finish Ensure reamer alignment. Ensure use of lubricants during 	Center drills (assorted range) Measuring and marking tools
 reaming. usage of measuring tools (plug gauge) as drawing requirement. Practical Activity: Reamed on drilled hole workpiece as per drawing. (adopt safety mothed) 	Reamers (assorted range) Plug gauge (assorted range)

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 5 Module Title: Carryout General Maintenance Objective of the Module:

This module identified the competencies required to perform maintenance functions by a machinist in accordance with the organization's approved guidelines and procedures. You will be expected to perform preventive maintenance of machines and tools as well as general housekeeping and maintenance of tools and machines. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:					
Total Time:	30 hours	Theory:	06 hours	Practical:	24 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials	Learning
				Required	Place
LU-1:	Trainee should be able to:	•	Total:		Theory:
Perform	Apply appropriate methods and	Knowledge of guidelines and	10hrs.	Machinery maintenance	Class room
General	techniques for cleanliness and maintenance of machines and	checklists to conduct	Theory:	tool kit	Practical:
Housekeeping	tools.	maintenance and housekeeping	02hrs.	Cotton rags	Lab/
& Maintenance	 Clean and maintain all workplace tools and machines as per 	of machines and tools	Practical:	Ū	workshop
	housekeeping checklists or	Adopt habit daily cleanliness of	08 hrs.	Lubricationg Oil and Oil	
	instructions given.Prepare check list for daily	the machine and workplace.		Gun	
	cleanliness of the workplace.			Air	
				Compressor	

 Respond appropriately to safety hazards on all bench-work tools and machines. Place all the tools and material in proper place to ensure safe work. Prepare Specific guidelines and checklists to conduct maintenance and housekeeping of machines and tools. 	 Adopt habit daily and as per given check list of oiling and lubrication. Knowledge of storing all tools and material in specified place. Knowledge of guidelines and checklists to conduct maintenance Housekeeping of machines and tools as instructions given. Maintain history record of assigned machine- 	Steel Almirah and Tooling Cabinet Maintenance trolley Kerosene Oil Notice
	 Practical activity: Perform general housekeeping of machine tools and accessories as per given instructions. 	Register and Stationary Grease and Grease gun
	perform general maintenance of lathe and milling machine.	WD-40

LU-2: Perform Preventive Maintenance	 Trainee must be able to: Read and interpret maintenance schedule carefully. Prepare oiling and greasing chart (daily, weekly as per machine requirement). Prepare machine history record covering date of installation, condition, oiling and maintenance. Inspect and assess the general condition of an assigned machine on regular basis. Observe problems and carry out routine maintenance as per given instructions and schedules. Identify faulty/damaged/ worn out parts and take appropriate steps to replace them. Report faults and problems of the machines to person concerned, if not controllable. 	 Personal protective equipment (PPEs) and workplace safety Understand machine operations Read and Understand machine manuals for oiling, greasing and function of machines Knowledge and scope of preventive maintenance of machines Preparation of check list for preventive maintenance of machines. Identify faulty/damaged/ worn out parts and removing minor faults_by replacing them. Maintaining history record of assigned machines. Observation of routine maintenance problems and solving_them. 	Total: 10hrs. Theory: 02 hours Practical: 08 hours	Grease and Grease Gun WD-40 Spray Thinner/ Kerosene oil and lubricating oil Machinery Installation and Maintenance Manual Cotton Rags Machinery Maintenance Tool kit	Theory: Class room Practical: Lab/ workshop
---	--	--	---	---	---

LU-3: Perform Maintenance of Tooling	 Trainee should be able to: Clean and maintain all benchwork tools and machines as perhousekeeping checklists or instructions provided. Prepare check list for daily cleanliness of the workplace. Respond appropriately to safety hazards on all bench-work tools 	 Practical Activity Demonstrate daily checking of assigned machines on regular basis. Prepare check list for preventive maintenance of assigned machines. Perform preventive maintenance of assigned machines as per given check list. Knowledge of guidelines and checklists to conduct maintenance and housekeeping of work bench machines and tools. Storing the tools and materials in specified place to ensure safe work. 	Total: 10 hours Theory: 02 hours Practical:	Grease and Grease Gun WD-40 Spray Thinner/ Kerosene oil	Theory: Class room Practical: Lab/ workshop
	 Identify all the tools and material in proper place to ensure safe work. Adopt methods and techniques 	 Adopt methods and techniques for cleanliness and maintenance of tools. Practical activity: 	08 hours	and lubricating oil Machinery Installation	-
for cleanliness and maintenance of tools.	 Store all cutting tools to maintain their sharpness as per given instructions. Resharp and clean the cutting tools as per prescribed method. 	and Maintenance Manual Cotton Rags Machinery Maintenance Tool kit File brush Drill angle gauge and tool angle gauge			
--	---	--			
		Tool grinder			

- 1. SUPPORTIVE NOTE: Assessment context, Critical aspects, Assessment condition, Resources required for assessment
- 2. LIST OF TOOLS, MACHINERY & EQUIPMENT (for standard class of 25-30 trainees)

Module: 6 Module Title: Perform Grinding Operations Objective of the Module:

This module identifies the competencies you need to perform grinding machine operations in accordance with approved procedures. You will be expected to perform different types of grinding which include off-hand, surface, universal cylindrical and tool and cutter grinding. You will be required to operate the grinding machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:					
Total Time:	150 hours	Theory:	15 hours	Practical:	135 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Perform Off- Hand Grinding	 Trainee should be able to: Hold the workpiece firmly against the rotating wheel by placing it on the tool rest. Grind the tool according to its required angle(s) as mentioned in the drawing. Adopt grinding methods and techniques that are safe and suitable to produce the workpiece as 	 Personal protective equipment (PPEs) and workplace safety Interpret basic drawings Measurement systems with protractor or gauges Understand of Pedestal grinding machine function and Its attachments Testing and mounting of grinding wheel 	Total: 22 hrs. Theory: 02hrs. Practical: 20 hrs.	Pedestal grinding machine along with standard accessories drill grinding attachments	Theory: Class room Practical: Lab/ workshop

Grind and check the tool angle(s) with protractor or tool gauge to ensure accuracy as per drawing.	 Knowledge of setting of tool rest Knowledge of care and maintenance of grinding machine_and wheel dressing Understand the use of drill grinding attachment Understand the importance of coolant. Understand the setting of tool rest and tool grinding procedures. Identify the standing position during grinding. Knowledge of types of cutting tools and their angles Practical Activity Perform tool grinding on pedestal grinding machine- Right hand roughing tool Right hand side tool Centre punch_and dot punch V-shape tools for chamfering and threads cutting Scriber Flat chisel Round nose tool Twist drill 	Diamond dressing tip with stand Measuring and marking tools Grinding wheel balancing stand with standard accessories Personal protective equipment and cotton rags Safety goggles Diamond disc grinding wheels for carbide materials (assorted
--	--	--

		•	Carry out wheel dressing and tool rest adjustment		Maintenance tool kit, general repairing tool kit and hands tool kit Steel Almirah and Tooling Cabinet	
Perform Surface Grinding	 Trainee must be able to: Check and dress the grinding wheel as per requirement with diamond dresser, if required. Mount the workpiece over the holding devices (magnet plate, vice or angle plate) as per standard practice. Set the sliding of table traverses according to the length and width for grinding of workpiece as per prescribed method. Maintain the safe distance between surface of workpiece and wheel as per prescribed method. Start grinding by locating the initial touching point and adjust the depth of cut according to the table speeds. 	• • • •	Personal protective equipment (PPEs) and workplace safety Understand the surface grinding machine, its attachment and function. Knowledge of kinds of grinding wheels and their applications. Testing and mounting of wheel. Apply proper methods and techniques for surface grinding Understand the mounting of workpiece on required holding device. (Magnetic chuck, grinding vice, Angle Plate, etc.) Understand the dressing of grinding wheel as requirement of workpiece.	Total: 33 hrs. Theory: 03 hrs. Practical: 33 hrs.	Surface grinding machine along with standard accessories Diamond dressing tip with stand Measuring and marking tools Grinding wheel balancing stand with	Theory: Class room Practical: Lab/ workshop

	 Apply coolants and perform surface grinding of workpiece as per prescribed method. 	 knowledge of setting of table feed and depth of cut. importance of continuous_use of coolants Practical Activity: Carry-out wheel balancing and mounting as per given instructions Carry-out wheel dressing as per prescribed method. Grinding of square and step job on surface grinding machine as prescribed method 		standard accessories Personal protective equipment and cotton rags -Cutting Oil Maintenance tool kit, general repairing tool kit and hands tool kit Steel Almirah and Tooling Cabinet	
LU-3:	Trainee should be able to:		Total:		Theory:
Perform Cylindrical Grinding	 Check and dress the grinding wheel as per requirement with diamond dresser, if required. Mount the workpiece over the holding devices (chuck, between centers and collet) as per requirements. 	 Personal protective equipment (PPEs) and workplace safety Understand the Universal Cylindrical grinding machine, its attachments and functions. Understand the internal and external grinding methods 	39 hrs. Theory: 04 hrs. Practical: 35 hrs.	Cylindrical grinding machine along with standard accessories	Class room Practical: Lab/ workshop

Set the sliding of table traverses	Knowledge of different kinds	Diamond
according to the workpiece	and type of grinding wheel for	dressing tip
dimensions for grinding of workpiece	internal and external grinding &	with stand
as per prescribed method.	it <u>s</u> applications.	
 Start grinding by locating the initial 	Testing and mounting of	Measuring
touching point and ensure the	grinding_wheel.	and marking
parallel grinding of workpiece as per	 Interpret basic drawings 	tools
standard.	Apply proper grinding methods	
 Apply coolants and perform 	and techniques for Universal	Grinding
cylindrical grinding of workpiece as	Cylindrical grinding. (Taper	wheel
per prescribed method.	grinding, parallel_grinding, step	balancing
•	grinding.)	stand with
Complete the job according to the	 Knowledge of different kinds_of 	standard
given dimensions and surface finish	measuring tools (inside, outside	accessories
as per drawing.	micrometer, snap plug gauge	Demonst
	taper plug and bush gauge.	Personal
	 Understand the mounting of 	protective
	workpiece on required holding	equipment
	device. (Between Two	and cotton
	Centers; Chuck; Collet; and	rags
	Face Plate)	
	 Understand the dressing of 	Hydraulic Oil
	grinding wheel as requirement	and Cutting
	of workpiece.	Oil
	Demonstrate the setting of	Maintenance
	table feed and depth of cut.	Maintenance
	Identify the importance of	tool kit,
	continuous use of coolants,	general
	Adopt Safety on Universal	repairing
	Cylindrical grinding machine	tool kit and
	Apply safety rule Universal	hands tool
		kit

		 Cylindrical grinding Practical Activity: Carry-out wheel balancing and mounting as per given instructions Carry-out wheel dressing as per prescribed method Grinding of workpiece on Universal Cylindrical Grinding. Taper grinding, parallel grinding and step grinding, etc. Perform internal grinding as per drawing. 	Cabinet	
LU-4: Perform Tool/Cutter Grinding	 Trainee should be able to: Select the suitable size, type and shape of grinding wheel as per job requirements. Select and mount the workpiece on its related attachment as per prescribed method. Set the workpiece, wheel and table movements as per job requirements. Grind the tool/cutter by following the safety and complete it by checking the angle(s) of sharp edges as per prescribed standard. Maintain the surface quality of workpiece by dressing the wheel according to prescribed standard. 	 Personal protective equipment (PPEs) and workplace safety. Measurement systems Introduction of Tool/cutter grinding machines and its attachments. Apply proper grinding methods and techniques for-Tool/Cutter grinding. Understand the mounting of Cutters on required holding device. (Collets; and setting of spiral attachment) Knowledge of different kinds and type of grinding wheel for grinding & its applications. Knowledge of Grinding of milling cutter(s) and special 	39 hrs.Tool/Cutter grinding machine along with standard accessories04 hrs.along with standard accessories97 actical:accessories35 hrs.Work holding devices and attachmentsDiamond dressing tip with stand	Theory: Class room Practical: Lab/ workshop

tools on tool/cutter grinding	Measuring
machine as per prescribed	and marking
method	tools
Practical Activity:	
 Testing and mounting of wheel according to job requirement. Grinding end mill _cutter, side and face cutter, shell end mill cutter and plain milling cutter. 	Grinding wheel balancing stand with standard
	accessories
	Personal protective equipment and cotton rags
	Diamond disc grinding wheels for carbide materials (assorted range)
	Maintenance tool kit, general repairing tool kit and hands tool kit

LU-5: Perform Centerless Grinding	 Trainee should be able to: Adjust the distance between grinding wheel, driving wheel and work-rest according to the diameter of the workpiece. Grind the workpiece and check its diameter according to the required dimension and adjust its diameter if required, to maintain the precision of workpiece. Apply coolants and perform grinding of workpiece as per prescribed method. 	 Interpret basic drawings Measurement systems knowledge of procedure of grinding of workpiece on Centerless Grinding Machine Understand the Centerless grinding machine and its attachments Knowledge of Grinding of cylindrical pin/hollow pipe on centerless grinding machine as prescribed method Practical Activity: Grinding of cylindrical pin on centerless grinding machine as per prescribed method. 	Total: 17 hrs. Theory: 02 hrs. Practical: 15 hrs.	Steel Almirah and Tooling Cabinet Centerless grinding machine along with standard accessories Work holding devices and attachments Diamond dressing tip with stand Measuring and marking tools Grinding wheel balancing stand with standard accessories	
--	--	--	--	--	--

	Personal protective equipment and cotton rags
	Maintenance tool kit, general repairing tool kit and hands tool kit
	Steel Almirah and Tooling Cabinet

3. SUPPORTIVE NOTE: Assessment context, Critical aspects, Assessment condition, Resources required for assessment

4. LIST OF TOOLS, MACHINERY & EQUIPMENT (for standard class of 25-30 trainees)

Module: 7 Module Title: Perform Shaping Operations Objective of the Module:

This module identifies the competencies you need to perform shaping operations on shaper machine in accordance with approved procedures. You will be expected to perform Facing, Step cutting, Squaring, slotting, V shape cutting with point cutting tool. You will be required to operate the shaper machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work

Duration:						
Total Time:	30 hours	Theory:	05 hours	Practical:	25 hours	

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Prepare Materials for Shaping Operations	 Trainee should be able to: Interpret drawing and arrange the material accordingly. Prepare workpiece by required machining (sawing and filing etc.) and get ready to clamp. Check and verify the dimensions of workpiece for shaping according to the drawing. 	 Introduction to shaping machine. Interpret basic drawings with respect to cutting of required material on power hacksaw. Understand the Measurement systems (measuring tool as per requirement) Mechanical Properties and strength of materials. Practical Activity: 	Total: 03 hrs. Theory: 01hrs. Practical: 02 hrs.	Power hacksaw, Hand Hacksaw, any required machinery for preparing raw material for shaping operations	Theory: Class room Practical: Lab/ workshop

		 Cut the required material on power hacksaw according to the drawing. Check the dimensions of cut material and deburr it. 		Common kinds and sizes of files (assorted range) Measuring and marking tools Personnel protective equipment	
LU-2: Select Tools and Equipment	 Trainee must be able to: Select the material and shape of tool(s) according to the job requirements. Arrange the measuring instruments and holding devices to attain accuracy of the work as per prescribed method. 	 understanding of shaping tools and their material. knowledge of clamping of Shaping tools and work holding device. understanding of measuring and angle checking gauge. Housekeeping of tools and equipment. Practical Activity: Select the required shaping tool as per given drawing. Check the tool angles of the shaping tool as per standard. 	Total: 03 hrs. Theory: 01hrs. Practical: 02 hrs.	HSS bar (12 x 12 x 200mm) (16 x 16 x 200mm) assorted range HSS shaping tools tungsten carbide Brazed tipped tool	Theory: Class room Practical: Lab/ workshop

LU-3: Set Shaper Machine for Operations	 Trainee should be able to: Clamp the material of workpiece and tool into its holding devices as per standard practice. Maintain the safe distance between surface of workpiece and tooltip as per prescribed method. Adjust the ram placement and stroke length according to the length of job. Adjust the parameters of shaping (speed and feed) from control unit as per prescribed method. Start shaping operation by locating the initial touching point and adjust the depth of cut according to the prescribed procedure. 	 Understanding the shaping machines and its types. Understanding the Ram and stroke settings. Calculate Feed and stock per minute and set as per the prescribed procedure. clamping of shaping tool for required operation Knowledge of Mounting and dialing of machine vice. clamping of workpiece for squaring as working procedure of shaping Understand shaping procedure. Perform Deburring and check size. Practical Activity: Mount machine vice and dial with Dial indicator Perform clamping of workpiece as per given instructions 	Total: 03 hrs Theory: 01hrs. Practical: 03 hrs	Measuring and marking tools General and maintenance toolkit Dial indicator with magnet stand lubrication oil Spanners and hammers Feed and speeds adjustments manual Stool	Theory: Class room Practical: Lab/ workshop
--	--	--	---	---	---

		 Mount the shaping tool as per prescribed procedure. Calculate the stroke per minute according to the job requirement. Adjust the length of stroke and ram position according to the job requirement. 		
LU-4: Perform Shaping Operations (Square Job)	 Trainee should be able to: Ensure the proper clamping of workpiece and the tool according to the standard practice. Start the shaping operation at top surface of workpiece to get flatness as per initial requirements. Re-clamp the workpiece by rotating 90° for next surface as per prescribed method. Shape entire workpiece by following the above stated method for next surface to get square shaped workpiece according to drawing. 	 Personal protective equipment (PPEs) and workplace safety. Interpreting information given in the engineering drawings and job specifications Perform clamping for squaring as proper procedure. understand square shaping procedure. Shaping side (1) deburr and re clamp side (2). Deburr and check angle then re clamp for side (3) deburr check angle and size. Re clamp the job and complete the square. Practical Activity: carry out shaping on square workpiece on Shaper Machine. 	Total:Shaping machine08 hrsShaping machineTheory:along with standard accessories02hrs.Fractical:06 hrsRaw material for producing square workpieceMachine vice and work holding devicesMeasuring and marking	workshop

		Personal protective equipment	Total:	Shaping	Theory:
Ensure the proper clamping of		(PPEs) and workplace safety.	11hrs	machine along with	Class room
workpiece and the tool according to the standard	•	Interpreting information given in the engineering drawings and job	Theory:	standard	Practical:
practice.		specifications.	01hrs.	accessories	Lab/
Mark the workpiece according to the drawing.	•	Perform marking the square workpiece according to the	Practical:	Raw	workshop
Set and align the sliding degree of head according to the required angle. Start the angular shaping operation to get required angle as per marked line. Shape entire workpiece by setting the required degree of head to get angle of workpiece according to drawing.	•	drawing Perform clamping for angle cutting as proper procedure. Understanding of setting angle on top slide as given drawing. understand angular shaping procedure. Shaping side (1) angle deburr and re clamp side (2) complete angle- Practical Activity: Prepare a single side Vee block	10 hrs	material for producing angular workpiece Machine vice and work holding devices Measuring and marking tools	
se he	tting the required degree of add to get angle of workpiece	• • • • • • • • • • • • • • • • • • •	 Shaping side (1) angle deburr and re clamp side (2) complete angle. Practical Activity: 	 Shaping side (1) angle deburr and re clamp side (2) complete angle. Practical Activity: Prepare a single side Vee block 	 Shaping side (1) angle deburr and re clamp side (2) complete angle. Practical Activity: Prepare a single side Vee block

1. SUPPORTIVE NOTE:

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

2. LISTOF TOOLS, MACHINERY & EQUIPMENT (for standard class of 25-30 trainees)

Module: 8 Module Title: Perform Turning Operations

Objective of the Module:

This Module identified the competencies required to perform lathe machine operations by a machinist in accordance with the organization's approved guidelines and procedures. You will be expected to perform facing, turning drilling/boring, taper turning, knurling and threading operations using lathe machine. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:						
Total Time:	360 hours	Theory:	14 hours	Practical:	332 hours	

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1:	Trainee should be able to:		Total:		Theory:
Prepare	Interpret drawing and arrange	 Introduction to the construction of lathe machine and its parts 	06 hrs.		Class room
Materials for	the material accordingly.	Introduction to various lathe	Theory:	Hand	Practical:
Lathe	Prepare workpiece by required machining (sawing and filing	machines and their typesIntroduction to standard accessories,	02hrs.	Hacksaw, any required	Lab/
Operations	etc.) and get it ready for	tooling attachments and work holding	Practical:	machinery	workshop
	clamping.Check and verify the	devices	04 hrs.	for preparing	

LU-2:	Trainee must be able to:			HSS lathe	Theory:
Select Tools and Equipment	 Select the tool(s) according to material of job and shape of the job requirements. Arrange the measuring instruments and holding devices to attain accuracy of the work as per prescribed method. 	 Understanding of Lathe tools and their materials. Understanding of lathe tools and its angles. understanding of Lathe tools and its material as required. understanding of Lathe tools and tool holding devices. Always use sharp tool for all turning operations. Handle and sharp tools with care. understanding of measuring and uses of angle checking equipment. Housekeeping of tools and equipment Select the required lathe tool as per operation, given in the drawing. Check the tool angles of the lathe tool as per standard. 	Total: 06 hrs. Theory: 02 hrs. Practical: 04 hrs.	tools Tungsten carbide tooltips with shanks Measuring and marking tools General and maintenance toolkit	Class room Practical: Lab/ workshop
LU-3:	Trainee should be able to:	Understand types of Lathe machines	Total:		Theory:
Set Lathe	Clamp the material of	• Understandholding devices and	06 hrs.	Dial indicator	Class room
Machine for	workpiece and tool into its holding devices as per	lathe attachments	Theory:	with magnet	Practical:
Operations	standard practice.	 Clamping of workpiece true running of job(s) and center alignment of tool 	02 hrs.	stand	Lab/
	 Maintain the safe distance between workpiece and tool tip as per prescribed method. 	tipUse of measuring and marking toolsCalculation of machining time.	Practical: 04 hrs.	, lubrication oil and cutting oil	workshop

	 Adjust the revolution per minute (rpm) of chuck according to the specifications of workpiece. Adjust the parameters of speed and feed from control unit as per prescribed method. 	 Procedure of safe clamping the workpiece. Clamping the tool and setting tool height Calculating cutting speed, RPM and feed for all turning operation. Setting of required RPM and Feed Clamping of workpiece, true running of job(s) and center alignment of tool tip. Importance and usage of coolants Wear specified cloths for in the work shop handle the heavy part carefully. Keep working space clean from oil and ching. 		HSS lathe tools Measuring and marking tools Feed and speeds adjustments manual	
		and chips.			
		Practical Activity:			
		 Clamp the different work holding devices as per given instruction. Clamp the work piece and through it as per prescribed method. Clamp the lathe tool in tool post and set its height as per standard. Calculate the requird RPM according to the workpiece and setting on machine. 			
LU-4:	Trainee should be able to:		Total:	Latha	Theory:
Carry-Out Lathe Operations	• Ensure the proper clamping of workpiece and the tool into the holding devices according to the required operation.	 Knowledge of various lathe operations and their settings 	342 hrs. Theory: 08 hrs.	Lathe machine along with standard accessories	Class room Practical: Lab/

 Maintain the alignm workpiece and locat tip at center position workpiece as per sta practice. Start the lathe opera required according t drawing and replaci required tool. Check the workpiec appropriate measur and instruments as standard practice. Produce a containing the operations with n prescribed method. 	 e the tool of the andard andard Knowledge of lathe machine accessories. Role of machinist during the machining operation Inspection and accuracy checking of workpiece Cleanliness and housekeeping of tools and equipment Practical Activity: 	f	Raw material for producing Lathe jobs Machine vice and work holding devices Measuring and marking tools Knurling tools Twist drill bits, boring tools,	workshop
	 Prepare a Shaft on Lathe Machine and perform the following operations as per prescribed method; Facing Facing Parallel Turning Step turning Taper turning Form turning Drilling/Boring Eccentric Turning Reaming 		, 0	

 Knurling Parting-off Grooving/Slotting Chamfering Threading (Internal/External) • Facing • Read and interpret given drawing for facing operation with safe working • Mount the clamping device (chuck) and clamp the job for true running • Clamp the tool and set Centre position at an angle of 30-degree for facing • Perform Facing operation of workpiece and Centre drill. • Re clamp the other side for facing,	
check and complete the length and perform Centre drill.Complete the workpiece as per given drawing	
• Parallel Turning	
 Read and interpret given drawing for parallel turning operation with safe working Mount the clamping device (chuck or Centre to Centre) and clamp the job for true running 	

 Clamp the Side turning tool and set Centre position perform parallel turning and check the_size (re-cut if required). Deburr and check the final size. Complete the workpiece as per given drawing 	
 Step turning Clamp the Side turning tool and set Centre position at 05 degreess. Initially perform parallel turning operation before step turning. Perform step turning with respect to diameter and length (step shoulder must be at 90 degree). Deburr and check diameter and length of workpiece. Complete the workpiece as per given drawing 	
• Taper turning	
 Read and interpret given drawing for taper turning operation with safe working Follow taper turning method as per workpiece required. Select taper turning tools for internal & external taper turning. Clamp the tool and set its Centre 	

 position. Calculate and set setting angle for taper. Calculate cutting speed, RPM and feed for taper turning. Perform taper turning operation and Check taper size as per drawing with Vernier caliper. Perform resetting if required. Check taper angle with taper gauge. Complete the workpiece as per given drawing Form Turning 	
 Read and interpret given drawing for form turning operation with safe working Follow Form turning method as per workpiece required. Select Form turning tools for Form turning. Clamp the tool and set its_Centre position. Calculate cutting speed, RPM and feed for Form turning. Carry-out form turning operation and Check the size(s) as per drawing with Form gauge. Perform resetting if required. 	

 Deburr and file the workpiece if required and Check with Form gauge. Complete the workpiece as per given drawing Eccentric Turning Read and interpret given drawing for eccentric turning operation with safe working Follow Eccentric turning method as per workpiece required. Select Eccentric turning tools for Eccentric turning. Mark the workpiece as per drawing. Centre drill at marked point on drill machine. Clamp the tool and set its_Centre position. Calculate cutting speed, RPM and feed for Eccentric turning. Clamp the workpiece in Centre to Centre position and turn diameter first, then Re-Clamp the other end of workpiece from other Centre holein Centre to Centre position again and turn and perform Eccentric turning operation 	
 operation. Deburr and check both diameters with Vernier caliper and gauge. 	

 Complete the workpiece as per given drawing o Drilling/ Boring Read and interpret given drawing for drilling/boring operation with safe working Select drills as per drawing for drilling. Calculate cutting speed, RPM and feed for drilling. Calculate cutting speed, RPM and feed for boring. Mount the clamping device and clamp the job property Perform drilling tool and set its Centre position. Perform boring speer drawing. Check size of drilled hole_then perform boring operation on the workpiece. Check size of bore with internal

 Read and interpret given drawing for reaming operation with safe working Select type of Reamer as per Drawing required. Calculate and turn initial bore size for Reaming. Clamp and set the Reamer straight at Centre position. Calculate cutting speed, RPM and feed for Reaming. Adopt standard_Reaming procedures and Perform Reaming_operation as per prescribed method. Check Reaming size as per drawing with internal micrometer or plug gauge. Complete the workpiece as per given drawing Knurling 	
 Read and interpret given drawing for knurling operation with safe working Select type of knurling tool as per Drawing required. Calculate and turn dia for Knurling. Clamp and set the Knurling tool straight at Centre position. Calculate cutting speed, RPM and feed for Knurling. Adopt standard Knurling procedures and Perform Knurling. 	

 Check impression, if ok then complete its one cut. Check Knurling size as per drawing with Vernier caliper. Grooving and slotting Read and interpret given drawing for grooving and slotting operation with safe working Follow Grooving and slotting operation as per standard. Select type of Grooving and slotting tool as per Drawing required. Calculate and turn dia for Knurling. Clamp and set the Grooving and slotting. Calculate cutting speed, RPM and feed for Grooving and slotting. Adopt standard Grooving and slotting. Adopt standard Grooving and slotting. Check Grooving and slotting. Check Grooving and slotting. Adopt standard Grooving and slotting. Check Grooving and slotting. Check Grooving and slotting. Adopt standard Grooving and slotting. Check Grooving and slotting. Check Grooving and slotting. Adopt standard Grooving and slotting. Check Grooving and sl

 Read and interpret given drawing for parting-off operation with safe working Follow Parting-off_operation as per standard. Select type of Parting-off tool as per Drawing required. Calculate and turn dia for Parting-off. Clamp and set the Parting-off tool straight at Centre position. Calculate cutting speed, RPM and feed for Parting-off. Adopt standard Parting-off procedures and Perform Parting-off operation. Check the dimensions of workpiece as per drawing with Vernier caliper. 	
o Threading	
(internal/external)	
 Understanding the kind of threads as per standard. Matric thread (American National Standard Thread) Matric fine thread Unified Thread - UNC Unified Course Thread Series - UNF Unified Fine Thread Series - UNEF extra fine thread series 	

Describe the kind of threads as per	
shape.	
 Vee thread Acme thread. 	
 Square thread Buttress thread 	
 Understand the Characteristics of 	
threads.	
 Calculation of the Characteristics of 	
threads	
 Grinding of the threading tools 	
Internal/ External according to	
thread.	
Calculate and set lead for threading act ing up of machine lead as	
setting up of machine lead as Procedure (change gears).	
 Mount of workpiece. 	
 Follow the safety and perform 	
threading sequence completely as	
per prescribed method.	
 Ensure all the required threading 	
cutting Procedure and completed it.	
Checking with thread gauge.	
 Mind the safety precautions involved 	
in threading operations_at each step.	
•	
Practical Activity:	
Prepare a Shaft on Lathe Machine	
with Facing, Parallel Turning, Step	
turning, Taper turning, Chamfering,	

	Drilling, Boring, threading (internal/external), Grooving and slotting operation.		

1. SUPPORTIVE NOTE:

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 9 Module Title: Perform Milling Operations

Objective of the Module:

This module identifies the competencies you need to perform milling operations on a Milling machine in accordance with approved procedures. You will be expected to perform Face milling, Plain milling, Step milling, Squaring, Gear milling, slotting, Grooving, Drilling and Boring. You will be required to operate the milling machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:					
Total Time:	360 hours	Theory:	14 hours	Practical:	332 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Prepare Materials for Milling Operations	 Trainee should be able to: Interpret drawing and arrange the material for milling operations according to the job requirement. Prepare workpiece for required machining (sawing and filing etc.) and get it ready to clamp. Check and verify the dimensions of workpiece for 	machines and their types	Total: 06 hrs. Theory: 02hrs. Practical: 04 hrs.	Hand Hacksaw, any required machinery for preparing raw material for Milling operations Milling Machine	Theory: Class room Practical: Lab/ workshop
	milling operations as per drawing.	•		with	

		 Personal protective equipment and workplace safety Understand mechanical Properties and strength of materials Interpret basic drawings with respect to cutting of required material on power hacksaw. Deburr the material and check size as per drawing. Understand the Measurement systems and_measuring tools as per requirement. Understand Importance and usage of coolants for cutting material. Practical Activity: Cut the required material on power hacksaw according to the drawing. 		standard accessories Machine vice and universal clamping vice Common kinds and sizes of files (assorted range) Personnel protective equipment	
LU-2:	Trainee must be able to:		Total:		Theory:
Select Tools and Equipment	 Select the material, type, shape and size of cutter(s) according to the job requirements. Arrange the measuring instruments and holding devices to attain accuracy of 	 Understanding of Milling Cutters and its usage. Selection of milling_cutter for required operation Calculate and set_of cutting speed, RPM and feed. understanding of various Milling Cutters and their materials. 	06 hrs. Theory: 02 hrs. Practical: 04 hrs.	End mill, ball mill and bull mill cutters (assorted range) Twist Drill bits and boring tools	Class room Practical: Lab/ workshop

	the work as per prescribed method	 understanding_types of Milling Cutters and their holding device. Always use sharp Milling Cutters for all Milling operations. Handle and sharp tools with care. understanding of measuring and angle checking equipment its used. Housekeeping of tools and equipment Practical Activity: Select the required milling cutters as per given drawing. 		(assorted range) Work holding devices Measuring and marking tools General and maintenance toolkit	
LU-3:	Trainee should be able to:		Total:	Dial	Theory:
Set Milling	Clamp the material of workpiece and tool into its	• Understand various types of Milling	06 hrs.	indicator	Class room
Machine for	holding devices as per	machines	Theory:	with magnet stand	Practical:
Operations	standard practice.	Understanding of Milling	02 hrs.	Stanu	Lab/
	Maintain the safe distance between workpiece and cutter	attachments, workpiece and cutter holding devices.	Practical:	Hydraulic oil,	workshop
	as per prescribed method.	 Use of measuring and marking tools 	04 hrs.	lubrication oil and	
	Adjust the revolution per minute (rpm) of spindle	Calculation of machining time.Procedure of safe clamping the		cutting oil	
	according to the specifications	workpiece on different attachments.		Feed and	
	of workpiece.Adjust the parameters of	 Mounting of cutters and setting Centre position. 		speeds	
	speed and feed from control	 Calculation of cutting speed, RPM 		adjustments manual	
	unit as per prescribed method.	and feed for all Milling operations.		manual	
		•_Importance and usage of coolants		Stool	
		•			

		 Wear specified cloths for in the work shop handle the heavy part carefully. Keep working space clean from oil and chips. Practical Activity: clamp the different work holding devices and set align with dial indicator (machine vice, angle plate, step clamps). clamp the various tool holding devices (Arbor, step arbor, collet holder). clamp the milling cutter and set the RPM accordingly. Perform clamping of workpiece as per given instructions 			
LU-4: Carry-Out Milling Operations	 Trainee should be able to: Ensure the proper clamping of workpiece and the cutter into the holding devices according to the required operation. Maintain the alignment of workpiece and locate the cutter at proper position of the workpiece as per standard practice. 	 Knowledge of various milling operations and their settings Personal protective equipment and workplace safety Operating milling machine according to the preparation of workpiece as per prescribed method. Role of machinist during the machining operation 	Total: 342 hrs. Theory: 08 hrs. Practical: 334 hrs.	Milling machine along with standard accessories Raw material for producing Milling jobs	Theory: Class room Practical: Lab/ workshop

 Start the required operations as per drawing and job specifications. Check the dimensions of the workpiece using appropriate measuring tools and make necessary adjustments. Plain milling Side milling Slotting Grooving Drilling Boring Reaming Gear forming and generating 	 Inspection and accuracy checking of workpiece Cleanliness and housekeeping of tools and equipment Practical Activity: Produce a component containing the following operations with marking as per prescribed method; Plain milling Side milling Slotting/Grooving Drilling/Boring Reaming Gear forming milling Read and Interpret information given in the engineering drawings and job specifications Mount arbor and plain milling cutter for squaring. Mount machine vice and dial with Dial indicator. Perform clamping for squaring as per proper procedure. Understand square milling procedure. Perform Deburring and check angle(s) and size(s). 	Machine vice and work holding devices Measuring and marking tools indexing head
--	---	---

 Complete the workpiece as per given drawing Side milling Interpret information given in the engineering drawings and job specifications Mount arbor and clamp side and face milling cutter on it for step milling operation. Mount machine vice and dial with Dial indicator. Perform clamping for step milling as per proper procedure. Follow proper step milling procedure. Perform Deburring and check angle(s) and length/ depth of step size. 	
• Slotting/ Grooving	
 Interpret information given in the engineering drawings and job specifications. Select appropriate kind of Grooving and slotting cutter as per drawing. Mount arbor and Grooving or slotting milling cutter for Grooving or slotting. 	

Mount machine vice and dial with	
Dial indicator.	
Perform clamping for Grooving or	
slotting as per proper procedure.	
Follow proper Grooving or slotting	
procedure.	
Perform Deburring and check width/	
depth of Grooving or slotting size.	
•	
Drilling/Boring	
Interpret information given in the	
engineering drawings and job	
specifications.	
select and mount drill holding-	
devices_as per requirement.	
Calculate and Set cutting speed,	
RPM and feed for drilling.	
Mark the workpiece for drilling/ baring as per drawing	
boring as per drawing.Perform drilling.	
 Understand the use of boring head 	
and mounting of boring bit.	
Calculate and Set cutting speed,	
RPM and feed for boring.	
Perform setting the bore bit in drill	
bore.	
Perform boring as per boring	
procedures.	
Check boring size with inside micro	
metre and plug gauge.	
 Enlist and adopted safety precautions and procedures during drilling and boring. Reaming Interpret information given in the engineering drawings and job specifications select and mount drill holding-devices_as per requirement. Calculate and Set cutting speed, RPM and feed for drilling. Mark the workpiece for drilling/boring as per drawing. Calculate drill size for Reaming. Perform drilling. Understand the use of boring head and mounting of boring bit. Set cutting speed, RPM and feed for 	
--	--
RPM and feed for drilling.Mark the workpiece for drilling/ boring as per drawing.	
Perform drilling.Understand the use of boring head and mounting of boring bit.	
boring.Perform boring as per boring procedures.Mount Machine reamer as per	
 drawing and ream the hole. Check Reamed size with plug gauge. Enlist and adopted safety precautions and procedures during 	
 drilling, boring and reaming. 	

Gear forming	
 Gear forming Interpret information given in the engineering drawings and job specifications Calculate Spur Gear Pitch dia, outside dia, root dia, Depth. Calculate the indexing as per No. of tooth. Perform clamping of indexing head on milling table and clamp gear blank on mandrel and hold in indexing head. Selection of cutter for required No. of tooth. Calculate and set cutting speed, RPM and feed. Ensure the setting of indexing plate and sector Aram. Mounting of module cutter and set Centre position of gear blank. Take the touching point for depth of cut. Perform indexing after each tooth with care. Complete gear cutting and check with tooth Vernier. Handle the heavy part (Indexing head) carefully. Keep working space clean from oil and chips. 	

Helical Gear	
 Calculate Helical Gear Pitch dia, outside dia, root dia, Depth and Lead for spiral angle. Calculate the indexing as per No. of tooth. Perform clamping of indexing head on milling table and clamp gear blank on mandrel and hold in indexing head. Calculate gear train set on indexing head and set table on required angle. Selection of cutter for required No. of tooth. Calculate and set cutting speed, RPM and feed. Ensure the setting of indexing plate and sector Aram. Mounting of module cutter and set Centre position of gear blank. Take the touching point for depth of cut. Perform indexing after each tooth with care. Complete gear cutting and check with tooth Vernier. Handle the heavy part (Indexing head) carefully. 	

 Keep working space clean from oil and chips. 		
Practical Activity:		
 Prepare aSquare workpiece on milling Machine with Square milling, Step milling, Slotting, Drilling/Boring at one end Rack cutting at one side. 		

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 10 Module Title: Generate Gear Objective of the Module:

This module identifies the competencies you need to perform gear cutting on milling and hobbing machine in accordance with approved procedures. You will be expected to perform different types of gear cutting which include spur gear, helical gear and bevel gear etc. You will be required to operate the milling and hobbing machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:					
Total Time:	200 hours	Theory:	08 hours	Practical:	192 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Prepare Blank for Generating the Gear	 Trainee should be able to: Interpret drawing and arrange the material according to job requirement. Prepare the workpiece by required machining (sawing and filing etc.) and get it ready for turning the blank. Check and verify the dimensions of blank for generating gear as per drawing. 	 Personal protective equipment and workplace safety Interpret basic drawings and cutting required material on power hacksaw. Understanding the Measurement systems (measuring tool as per requirement) Understanding of Mechanical Properties and strength of materials and material for gears. Understand the procedures of drilling and boring operation on lathe. 	20 hours Theory: 02 hours Practical: 18 hours	Lathe Machine, Hand Hacksaw, any required machinery for preparing raw material for Gear forming and generating operations	Theory: Class room Practical: Lab/ workshop

	•	 Calculate cutting speed, RPM and feed for drilling and boring operations on lathe. Face a side drill and bore the workpiece then ream it as prescribed in drawing. Deburr and check with plug gauge. Mount the blank on mandrel. Mount workpiece on lathe Centre to Centre, complete the length and outside dia. Chamfer the both end of blank on 15 degrees. Deburr and check the blank. Practical Activity:		Machine vice and universal clamping vice Common kinds and sizes of files (assorted range) Personnel protective equipment	
LU-2: Select Tools and Equipment for Gear Cutting	 Trainee must be able to: Select the material, type, shape and size of cutter(s) according to the job requirements. Arrange the measuring instruments and holding devices to attain accuracy of the work as per prescribed method. 	 gear as per drawing. Introduction to gear forming Introduction to gear generating Gear forming tools and equipment Gear generating tools and equipment Difference between gear forming and gear generating Understand of Hobbing Cutters and its usage. Selection of Hob cutter for required operation Calculate and set cutting speed, RPM and feed. 	Total: 06 hours Theory: 02 hours Practical: 04 hours	Gear Hobbing Machine Indexing Head Gear cutters and Hobs (assorted range)	Theory: Class room Practical: Lab/ workshop

		 understanding of Hobbing Cutters and Cutters holding device and workpiece holding device. Safety precautions for gear cutting. Housekeeping of tools and equipment Practical Activity: Select the gear cutters according to the drawing. Select the Hob cutters according to the drawing. 		Measuring and marking tools Work holding devices General and maintenance toolkit	
LU-3: Set Hobbing Machine for Operations	 Trainee should be able to: Clamp the gear blank and hob cutter into their holding devices as per standard practice. Maintain the safe distance between gear blank and hob cutter as per prescribed method. Adjust the revolution per minute (rpm) of hob cutter and table according to the specifications of workpiece. Adjust the parameters of speed and feed from control unit as per prescribed method. 	 Introduction to the construction of hobbing machine and its parts Introduction to various hobbing machines and their types Introduction to standard accessories, attachments and work holding devices Introduction to hobbing operations Understand Structure and functions of Hobbing machine. Accessories of Hobbing machine and types of different tooling. Use of gear Hob cutters, marking tools, measuring instruments and gauges. Understand the Types of gears it mounting and setting. 	Total: 06 hours Theory: 02 hours Practical: 04 hours	Dial indicator with magnet stand , lubrication oil and cutting oil Feed and speeds adjustments manual Stool	Theory: Class room Practical: Lab/ workshop

·		
	 Types of materials used for generating the gears. Types of indexing such as single, angled and differential and techniques of producing indexing. Understand the setting of change gear for different generating the gears. Interpreting drawings and specifications used for gear cutting. Method of calculating machine speed, feed, etc. Measurement techniques, mathematical calculations, indexing measurements etc. Use of various devices and attachments for holding the workpiece. Method of setting up the Hobbing machine for gear generating operations. Method of positioning hob cutter and workpiece in the Hobbing machine. Procedure of gear generating. How to avoid undercutting in gears. 	Hob Cutters Gear Hobbing machine Measuring and marking tools
	 Set the Hobbing Machine for generating Helical Gear (mount the gear blank, Mount and set Hob 	

LU-4: Carry out Hobbing Operations for Gear Generating	 Trainee should be able to: Produce simple, angled, differential indexing and divide the gear into required number of divisions. Check the hob cutter and the gear blank that both are positioned properly and adjust them, if required. Operate hobbing machine according to given specifications and ensure all the parameters of the gear are met using relevant instruments. Check and confirm the measurements with given specifications and finalize the gear by removing defects or shortcomings. 	 Cutter, lead machine speed, feed, etc. Personal protective equipment and workplace safety Calculation of Helical Gear/spur Gear Pitch dia, outside dia, root dia, Depth and Lead for spiral angle. Selection of Hob cutter for required No. of tooth. Calculation of indexing as per No. of tooth. Perform clamping of gear blank on mandrel and mounting on Hobbing Machine. Calculate gear train and setting on machine and setting of on required angle. Selection of Hob cutter for required No. of tooth. Calculate gear train and setting on machine and setting of on required angle. Selection of Hob cutter for required No. of tooth. Calculate and setting of cutting speed, RPM and feed. Mounting of Hob cutter and set Centre position of gear blank. Take the touching point for depth of cut. Complete gear cutting and check with tooth Vernier. 	Total: 160 hours Theory: 08 hours Practical: 168 hours	Gear hobbing machine along with standard accessories Raw material for generating Gears Machine vice and work holding devices Measuring and marking tools	Theory: Class room Practical: Lab/ workshop
---	---	--	---	--	---

	 Prepare Helical Gear on Hobbing 		
	Machine		
	•		

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 11 Module Title: Develop Drawing and Design Objective of the Module:

This module identifies the competencies you need to perform Interpret drawing requirements Select, configure and use appropriate computer application for developing 2D sketch drawing and develop 3D models of required product or component with accurate dimensions and compare it as per job requirements.

complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:					
Total Time:	200 hours	Theory:	10 hours	Practical:	190 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Develop 2D Sketch /Drawings	 Trainee should be able to: Interpret drawing requirements for the product(s) or component to be produced. Select, configure and use appropriate computer application for developing drawing of required product or component. Select and use appropriate 	 Understand Operating of computer systems as well as IT skills. Understand Basic geometrical shapes e.g. circular, square, rectangular, cylindrical, conical, profiles, polygonal, etc. Understanding of isometric and oblique drawing 	Theory: 04hrs. Practical: 86 hrs.	Drawing board and drawing instruments Complete computer	Theory: Class room Practical: Lab/ workshop
	 Select and use appropriate user interface and apply 	Understand Orthographic representation of drawings.		set with scanner and	

	 relevant commands for developing mechanical drawing(s). Produce drawing(s) according to the required dimensions by use of various drawing standards to meet job requirements. 	 Understand 1st angle and 3rd angle projection methods. Measurement systems and their conversions. File management in computer system. Knowledge of standard sheet sizes Drawing standards and conventions Understanding of title block Types of lines and standard symbols Practical Activity: Draw 2D_drawing(s) with dimensions 		printer along with computer table Engineering drawings manual Measuring and marking tools	
		 Draw 2D_urawing(s)_with dimensions alongwith title block according to the required dimensions by use of various drawing standards as per given assignment. 		CAD software	
LU-2: Develop 3D Models	 Trainee must be able to: Check and inspect design requirements for the product or component to be produced. Select, configure and use appropriate computer application for developing 3D model(s) for the product, component or assembly. Select and use appropriate user interface and apply relevant commands for 	 Understand Use of Computer Aided Design (CAD) software application for making of drawing(s) and designs. Method of configuration CAD software. Knowledge of User interface customization of CAD software. Common commands and tools used in CAD software. Surfaces and solid modeling in CAD. 	Theory: 06 hrs. Practical: 104 hrs.	Complete computer set with scanner and printer along with computer table Engineering drawings manual	Theory: Class room Practical: Lab/ workshop

 developing 3D model(s) or component. Produce models with accurate dimensions and compare it as per job requirements. 	 Draw 2D sketch and 3D model of Connecting Rod / Crank-shaft. 2D sketch and 3D model must be as per requirement 	Measuring and marking tools
•	Practical Activity:	CAD software
	 prepare 3D model of Connecting Rod / Crank-shaft with accurate dimensions and compare it as per job requirements. 	

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 12 Module Title: Maintain CNC Machines and Tools Objective of the Module:

This module identifies the competencies you need to Computerized Numerical Control (CNC) Machines operations in accordance with approved procedures. You will be expected to maintain fluid levels, check coolant condition and change if required. Inspect sharpness of cutting edges of tool/cutter to gain maximum precision and accuracy as per standard requirements. Re sharp if required. Ensure the selection and clamping of cutting tools as per standard method to avoid any injury or accident.

Duration:						
Total Time:	20 hours	Theory:	06 hours	Practical:	14 hours	

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Maintain proper fluid levels	 Trainee should be able to: Check and maintain normal level of fluid(s) used in the CNC machine according to its requirements. Check and attain the required pressure (hydraulic and pneumatic) according to the machine requirements. 	 Using PPEs and following safety precautions during the work kinds of fluids and its properties effects of heat and friction on metals knowledge of types of coolants and hydraulic oils Inspection of cutting fluid supply system in the machine working system of chip conveyor Operating air blower according to the job requirements 	Total: 06 hours Theory: 02 hours Practical: 04 hours	Machinery maintenance tool kit Cotton rags Lubrication Oil and Oil Gun Air Compressor Steel Almirah and Tooling Cabinet	Theory: Class room Practical: Lab/ workshop

LU-2: Change machine oil /coolant	 Trainee must be able to: Check condition of coolant (color, smell, viscosity, etc.) and level of coolant according to the machine requirements. Change coolant as per requirements of machine. 	•	Practical Activity: Dis-assemble and assemble the tank/container of coolant reservoir after its proper cleaning Using PPEs and following safety precautions during the work Understanding draining system of fluids from tanks/containers. Practical Activity: Refill lubrication oil into its container as per prescribed procedure	Total: 06 hours Theory: 02 hours Practical: 04 hours	Fire Extinguisher Kerosene Oil Notice Register and Stationary Grease and Grease Gun WD-40 Spray Machinery Installation and Maintenance Manual Cotton Rags General tool kit and Maintenance Tool kit	Theory: Class room Practical: Lab/ workshop
LU-3:	Trainee should be able to:	•	Understand terms and	Total:		Theory:
Maintain cutting tools	• Select appropriate tool/cutter and perform proper housekeeping of them for further uses as per prescribed procedure.	•	significance of single point cutting tool and its geometry Understanding proper tooling specifications, angles, cutting edges, etc. Acquire proper housekeeping of tools and equipment	08 hours Theory: 02 hours Practical: 06 hours	CNC Lathe and Milling Machines Pedestal grinding machine,	Class room Practical: Lab/ workshop

 Inspect sharp and cutting edges of tool/cutter to gain maximum precision and accuracy as per standard requirements. Ensure proper clamping of tool/cutter to avoid any injury or accident as per standard method. Sharp blunt edges or change tool/cutter as and when required according to standard cutting operations. Use appropriate cutting speed/feed and coolant as per standard machining features. 	 Knowledge of re-sharpening of blunt edges of cutting tools. Understand of Tooling specifications, angles, cutting edges. Practical Activity: Grind and sharp the end of H.S.S. bar into single point cutting tool for lathe operations and keep it safe for further use. Replace the blunt edges of inserts (lathe tools and milling cutters) 	Tool/cutter grinding machine along with standard accessoriesHSS bar (8 x 8 x 160mm) (12 x 12 x 200mm) (16 x 16 x 200mm) Assorted rangeAnti-rust oilMachinery Installation and Maintenance ManualCotton RagsMachinery Maintenance Tool kit
--	---	--

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 13 Module Title: Perform CNC Lathe Operations Objective of the Module:

This module identifies the competencies you need to Computerized Numerical Control (CNC) Machines operations in accordance with approved procedures. You will be expected to maintain fluid levels, check coolant condition and change if required. Inspect sharpness of cutting edges of tool/cutter to gain maximum precision and accuracy as per standard requirements. Re sharp if required. Ensure the selection and clamping of cutting tools as per standard method to avoid any injury or accident.

Duration:					
Total Time:	150 hours	Theory:	16 hours	Practical:	134 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Mount the job	 Trainee should be able to: Mount the workpiece by considering the working capacity of machine as well as job requirement according to the drawing/design. Select appropriate work holding device(s) in order to achieve dimensional accuracy and clamp the job firmly as per 	 Introduction to CNC Lathe and CNC Turning Centre Introduction to CNC Lathe Machine axes. Introduction to Machine Control Unit and its operating Be aware of personal and work place safety Work with proper use of PPE's 	Total: 06 hours Theory: 02 hours Practical: 04 hours	CNC Lathe machine along with standard accessories Personal protective equipment	Theory: Class room Practical: Lab/ workshop

 Attain proper alignment of tool/cutter and workpiece e.g. concentricity of rotating jobs as per set practice. Keep safe measures while mounting the workpiece so that unwanted operation by machine may not be initiated as per safety precautions. 	 Understand relation between tooling and workpiece alignment Practical Activity: Mount the workpiece (mild steel round bar; Ø50 x 75mm) into 3 jaws chuck of CNC lathe machine and extend its working end upto 50mm beyond the jaws for further lathe operations and clamp it rigidly. Ensure its true running and mount the single point cutting tool into its holding device and adjust proper alignment between tooltip and central axis of rotation of the job as per prescribed method. Take reference point according to the drawing and register coordinates values of reference point into work coordinates system dialogue as per demonstrated 	HSS bar (8 x 8 x 160mm) (12 x 12 x 200mm) (16 x 16 x 200mm) Assorted range Tungsten carbide tips with shanks/hold ers Work holding devices and machinery attachments
--	--	--

LU-2: Generate the program	 Trainee must be able to: Interpret job requirement, calculate extra material to be removed and define reference point as per drawing/design. Define absolute or incremental coordinates system, toolpath strategies, machining features and tool compensation for generating the toolpath as per standard procedure. Use appropriate part programming credentials (Sequence, G-codes, M-codes, coordinates, feed, speed, tooling information, etc.) according to the CNC machine control unit. Keep record of generated part program in soft/hard form in order to feed into machine control unit as per standard procedure. 	 Understand relation between machine coordinates system and work coordinates system Acquire home positioning and reference positioning subsequently Understand graph and cartesian coordinates system Work with absolute and incremental coordinate systems Interpret the drawing and develop CNC programe to be machined according to the job requirements Calculate the required coordinates from drawing for CNC programing. Understanding of ISO G and M codes CNC programming. Understanding of ISO G and M codes according to the into its appropriate extension (*.tab or *.nc file, etc.) The program must contain the following operations in blockwise details according to the machine control unit. Facing Step Turning 	Total: 06 hours Theory: 02 hours Practical: 08 hours	ISO G codes and M codes manual Appropriate CAD/CAM Software for CNC Lathe Operations Job monitoring sheet for CNC Lathe Machine	Theory: Class room Practical: Lab/ workshop
----------------------------------	--	--	---	---	---

LU-4: Feed the		 Refer to the appropriate simulation platform at CNC lathe machine/PC and import the generated part programming file for further gouge checking. Run the simulation blockwise and ensure safe machining at each step as per prescribed method. Construction of proper synchronization for part program and its feeding to the machine control unit 	Total: 06 hours	06 hours Machine	
program	 between machine control unit and part program file as per standard operating procedure. Switch machine to receiving mode and feed the desired part program file into machine control unit for further execution as per standard operating procedure. Select the desired part program file for execution as per standard operating procedure. 	 Switching machine control unit mode to receiving mode from the control panel Transferring the part program file to the machine control as per prescribed method Practical Activity: Feed and activate the generated part program file into machine control unit for further execution of machining operations as per prescribed method. 	Theory: 02 hours Practical: 04 hours	control unit and NC file synchronizat ion toolkit and accessories Machine control unit operating manual	Practical: Lab/ workshop

LU-5: Perform CNC Lathe Operations	 Trainee should be able to: Ensure to control the safe operation of working on CNC machines before executing part program according to the safety measures. Control the feeds, speeds and override of machine before operating according to the prescribed procedure. Switch machine to execution mode (single block or auto) and press cycle start to run the machining sequence as per prescribed method. Compare the block-wise movements of machining sequence thoroughly during operating of machine according to the part program file. Complete the job and inspect its accuracy and precision according to the drawing/design. 	 Selection of lathe tools and its types with respect to operations and materials of workpiece Attain the proper alignment of tooltip in-line with the center of rotation of workpiece Select proper lathe tools and its types with respect to operations and materials of workpiece Control the feed and speed adjustments in Lathe machine operations before starting the operation Running the lathe operation such as facing, turning, drilling, grooving, threading, knurling, boring etc. as per program, inserted and executed into the machine control unit Monitoring step by step operations performed by lathe machine as per job requirements 	08 hours Practical: 118 hours:	Feed and speeds adjustment manual Machine control unit maintenance manual	Theory: Class room Practical: Lab/ workshop
---	--	--	--------------------------------------	--	---

	Start CNC lathe machine operations		
	and observe the operation of producing		
	the job as per drawing.		

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 14 Module Title: Perform CNC Milling Operations Objective of the Module:

This module identifies the competencies you need to Computerized Numerical Control (CNC) Milling Machine operations in accordance with approved procedures. You will be expected to set CNC Milling Machine to perform milling operations. You will be required to operate the Milling machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:					
Total Time:	150 hours	Theory:	16 hours	Practical:	134 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Mount the job on Milling Machine	 Trainee should be able to: Mount the workpiece by considering the working capacity of machine as well as job requirement according to the drawing/design. Select appropriate work holding device(s) in order to achieve dimensional accuracy and clamp the job firmly as per standard practice. 	 Introduction to CNC Milling and CNC Machining Centre Introduction to CNC Milling Machine Axes Introduction to Machine Control Unit and its operating personal and work place safety Work with proper use of PPE's Understand relation between tooling and workpiece alignment 	Total: 06 hours Theory: 02 hours Practical: 04 hours	CNC Milling machine along with standard accessories Personal protective equipment	Theory: Class room Practical: Lab/ workshop

	 Attain proper alignment of tool/cutter and workpiece e.g. co-axiality, concentricity of rotating jobs as per set practice. Keep safe measures while mounting the workpiece so that unwanted operation by machine may not be initiated as per safety precautions. 	Practical Activity: Mount the workpiece (mild steel rectangular bar; $100 \times 65 \times 35$ mm) into machine vice of CNC milling machine and extend it upto 20mm beyond the vice jaws for further milling operations and clamp it rigidly. Mount the end mill cutter - Ø 10 x 70mm into spindle and extend its tooltip upto 40mm beyond the collet for smooth machining. Locate the reference point at top centre of the block as per prescribed method. Register coordinates values of reference point into work coordinates system dialogue as per demonstrated method.		End mill, ball mill, bull mill cutters (Assorted range) Tungsten carbide tips with shanks/hold ers Work holding devices and machinery attachments	
LU-2: Generate the program for CNC Milling	 Trainee must be able to: Select appropriate CAM software according to the machine control unit and 	 Understand relation between machine coordinates system and work coordinates system 	Total: 06 hours Theory: 02 hours	CNC Milling machine and CNC Machining	Theory: Class room Practical:

 import 3D model into it as per standard procedure. Define reference point and apply material/stock for machining to the design/model as per job requirements. Apply machining feature(s), toolpath strategies and leads/links as per prescribed procedure. Generate part program file against the applied machining sequence according to the post processor of CNC machine. Use appropriate part programming credentials (Sequence, G-codes, M-codes, coordinates, feed, speed, tooling information, etc.) according to the CNC machine control unit. Keep record of generated part program file in order to feed into machine control unit as per standard procedure. 	 Acquire home positioning and reference positioning subsequently Understand graph and cartesian coordinates system Work with absolute and incremental measuring systems Interpret and develop drawing to be machined according to the job requirments Use proper CAM software for generating part program for milling operations according to the job requirments Practical Activity: Generate the ISO G and M Codes part program and save it into its appropriate extension (*.tab or *.nc file, etc.). The program must contain the following operations in blockwise details according to the machine control unit. Plan milling Side milling Slot milling 	Practical: 08 hours	Centre along with standard accessories ISO G codes and M codes manual Appropriate CAD/CAM Software for CNC Lathe Operations Job monitoring sheet for CNC Milling Machine	Lab/ workshop
--	--	------------------------	--	------------------

LU-3: Run simulation	 Trainee should be able to: Feed the generated part program into appropriate simulation platform and run simulation for checking the tool gouge according to safety measures. Run simulation and verify movements of tool/cutter to get same results as per defined sequence. Identify occurrence of errors and modify the program as per defined procedure. 	 Details and dimensions are mentioned in attached drawing "Milling operations – 002.pdf" with respect to the end mill cutter "Ø 10 x 70mm" (HSS) Switching machine control unit between various mode of operating from control panel Run and control auto program as well as block wise execution Program editing and debugging techniques Select and operation of proper Simulation software Work with tool magazine and tool mounting/ dismounting techniques possible accidents and their remedies regarding work resuming techniques Understand G and M codes as well as the methods and techniques of calculating programming coordinates according to the drawing Practical Activity: Refer to the appropriate simulation platform at CNC milling machine/PC 	Total: 06 hours Theory: 02 hours Practical: 08 hours:	CNC Milling Machine and CNC Machining Centre along with standard accessories CNC Milling machine operating manual Machine control unit operating manual NC Files simulation software	Theory: Class room Practical: Lab/ workshop
				simulation	
		and import the generated part		Machine control unit	

LU-4:	Trainee should be able to:	 programming file for further gouge checking as per set practices. Run the simulation blockwise and ensure safe machining at each step as per prescribed method. Understand various accessories of 	Total:	synchronizat ion manual	Theory:
Feed the program into CNC Milling	 Ensure proper synchronization between machine control unit and part program file as per standard operating procedure. Switch machine to receiving mode and feed the desired part program file into machine control unit for further execution as per standard operating procedure. Select the desired part program file for execution as per standard operating procedure. 	 milling machine and their usage Working with automatic tool changer and tool mounting/un-mounting techniques Accidents and their remedies regarding work resuming techniques Construction of proper synchronization for part program and its feeding to the machine control unit Switching machine control unit mode to receiving mode from the control panel Transferring the part program file to the machine control as per prescribed method Practical Activity: Feed and activate the generated part program file into machine control unit for	06 hours Theory: 02 hours Practical: 04 hours	Machine control unit and NC file synchronizat ion toolkit and accessories Machine control unit operating manual	Class room Practical: Lab/ workshop
		further execution of machining operations as per prescribed method.			

Perform CNC Milling Operations	ainee should be able to: Ensure to control the safe operation of working on CNC machines before executing part program according to the safety measures. Control the feeds, speeds and override of machine before operating according to the prescribed procedure. Switch machine to execution mode (single block or auto) and press cycle start to run the machining sequence as per prescribed method. Compare the block-wise movements of machining sequence thoroughly during operating of machine according to the part program file. Complete the job and inspect its accuracy and precision according to the drawing/design.	 Selection of milling cutters/tools and its types with respect to operations and material of workpiece attaining the proper alignment of cutter and its rigid clamping against the workpiece Select proper milling cutters and its types with respect to operations and materials of workpiece Control the feed and speed adjustments in milling machine operations before starting the operation Run the milling operation such as plane milling, side milling, drilling, boring, grooving, slotting, pocket milling etc. as per program, inserted and executed into the machine control unit Monitor step by step operations performed by milling machine as per job requirements 		Feed and speeds adjustment manual Machine control unit maintenance manual	
--------------------------------------	---	---	--	--	--

	Start CNC milling machine operations		
	and observe the operation of producing		
	the job as per drawing.		

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

Module: 15 Module Title: Perform CNC EDM Wire Cut Operations Objective of the Module:

This module identifies the competencies you need to Computerized Numerical Control (CNC) EDM Wire-cut operations in accordance with approved procedures. You will be expected to set CNC EDM Wire-cut Machine to perform machining operations. You will be required to operate the EDM Wire-cut machine safely by complying the organizational safety policy and approved procedures. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration:					
Total Time:	120 hours	Theory:	16 hours	Practical:	104 hours

Learning	Learning Outcomes	Learning Elements	Duration	Materials	Learning
Unit				Required	Place
LU-1: Mount the job on EDM Wire Cut Machine	 Trainee should be able to: Mount the workpiece by considering the working capacity of machine as well as job requirement according to the drawing/design. Select appropriate work holding device(s) in order to achieve dimensional accuracy and clamp the job firmly as per standard practice. 	 Introduction to EDM Technology and kinds of EDM Machines Introduction to CNC EDM wire cut Machine Introduction to CNC EDM wire cut Machine axes. Introduction to CNC EDM wire cut Machine Control Unit and its operating personal and work place safety Working with proper PPE's 	Total: 06 hours Theory: 02 hours Practical: 08 hours	CNC wirecut machine along with standard accessories Personal protective equipment Molybdenum wire spool	Theory: Class room Practical: Lab/ workshop

 Install and adjust proper alignment of installed wire to the vertical direction as per standard practice. Keep safe measures while mounting the workpiece and installing the wire so that unwanted operation by machine may not be initiated as per safety precautions. 	 Understand the relation between machine coordinates system and work coordinates system Acquire home positioning and reference positioning subsequently Working principal of CNC wirecut machine and its accessories Understand workpiece clamping techniques Understand about the material of wire, its specifications and diameter Importance of locking and unlocking of table traverses handles Wire installation method and its alignment 	(0.18 diameter) Work holding devices and machinery attachments Lever type dial indicator
	Practical Activity:	
	Inspect the proper flatness of machine	
	table with bubble level indicator before	
	starting of the work as per prescribed	
	method.	
	Mount the workpiece (mild steel	
	rectangular bar; 150 x 100 x 12mm) on	
	CNC wirecut machine as per prescribed	
	method.	

		Dial the workpiece with help of lever type dial indicator. Install the wire and align it as per set practices. Locate the reference start point according to the drawing. Register/lock coordinates values of reference point as per demonstrated method.			
LU-2: Generate the program	 Trainee must be able to: Select appropriate part programming software according to the machine control unit and import drawing/sketch into it as per standard procedure. Define reference point also known as start point and apply toolpath by considering the wire compensation according to the prescribed procedure. Execute the generated part program file in order to perform wire cutting operation as per prescribed method. 	 Understand drawing file extension and its types Feed the desired drawing to be executed into the machine control unit for further part programming Indicate of the location of starting reference point of work in the drawing into its appropriate software Generate the program as per drawing Practical Activity: Load the drawing "Wirecut Operation – 003" into appropriate software of wirecut machining module and locate the 	Total: 06 hours Theory: 02 hours Practical: 04 hours	CNC wirecut machine along with standard accessories ISO G codes and M codes manual Appropriate CAD/CAM Software for CNC wirecut Operations	Theory: Class room Practical: Lab/ workshop

	T	reference start point as per demonstrated method. Adjust wire compensation offset on outside periphery and apply it as per prescribed method.	Total:	Job monitoring sheet for CNC wirecut Machine	Theory:
Run simulation	nlatform and run simulation of	 simulation checking from the control panel Gouge check the program for further execution according to the safe working operation Checking the working parameter on simulation software properly Be aware from occurrence of possible accidents and their counteractions Practical Activity: Refer to the appropriate simulation platform at CNC EDM wirecut machine 	06 hours Theory: 02 hours Practical: 04 hours	CNC wirecut machine operating manual	Class room Practical: Lab/ workshop
	and ensure its proper working by inspecting the generated cut path as per drawing.		control unit synchronizat ion manual		

LU-4: Feed the program	 Trainee should be able to: Ensure proper synchronization between machine control unit and part program file as per standard operating procedure. Select and execute the desired part program file as per standard operating procedure. 	 Understand various accessories of wirecut machine and their usage Construct proper synchronization for part program and its feeding to the machine control unit Switching machine control unit mode to receiving mode from the control panel Transfer of the part program file to the machine control unit and activate it as per prescribed method Practical Activity: Load and activate the generated cut path into machine control unit for further execution of machining operations as per prescribed method. 	Total: 06 hours Theory: 02 hours Practical: 04 hours	Machine control unit and NC file synchronizat ion toolkit and accessories Machine control unit operating manual	Theory: Class room Practical: Lab/ workshop
LU-5: Perform CNC EDM Wire-cut Operations	 Trainee should be able to: Ensure to control the safe operation of working on EDM wire-cut machine before execution of part program according to the safety measures. Adjust the feeds, speeds by adjusting amperes and current setting before operating according to the prescribed procedure. 	 Understand the alignment of wire and rigid clamping of the workpiece adjustment the feed and speed controls on wirecut machine before starting the operation Run the wirecut operation such as internal and external profile cutting as per program executed into the machine control unit 	Total: 96 hours Theory: 08 hours Practical: 104 hours	Current, ampere, and speeds adjustment manual Machine control unit maintenance manual	Theory: Class room Practical: Lab/ workshop

 Switch machine to execution mode and start to work on defined toolpath as per prescribed method. Compare the movements of machining sequence thoroughly during operating of machine according to the part program file. Complete the job and inspect its accuracy and precision according to the drawing/design. 	 Monitoring step by step operations performed by machine as per job requirements Program controlling and resuming techniques Practical Activity: Adjust ampere, current and speed parameters etc. as per requirement, also adjust coolant lines as per demonstrated procedure. Start CNC wirecut operations and observe the operation of producing the job as per drawing. 		
--	---	--	--

Assessment context, Critical aspects, Assessment condition, Resources required for assessment

National Vocational and Technical Training Commission (NAVTTC)

- 🚨 Plot 38, Kirthar Road, Sector H-9/4, Islamabad, Pakistan
- 🜭 +92 51 9044 322
- ☞ +92 51 9044 322
- 🖄 info@navttc.org
- © www.navttc.org