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DIES AND MOULDS MAKER

TRAINER GUIDE

National Vocational Certificate Level 2

Version 1 - September, 2019

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Introduction

Competence-based training helps to bridge the gap between what is taught in training and what tasks will be performed on the job. Training trainees to perform actual job functions helps to ensure that future front-line workers have the skills, knowledge and abilities required to perform their jobs properly, safely and effectively. In addition to competence-based training, assessment based on the performance of actual work competencies helps to ensure that:

- trainees are performing their work tasks as safely as possible
- performance gaps are recognized prior to serious incidents
- training can be implemented to improve competence.

There are significant benefits to competence-based training:

1. **Cost effectiveness**

   Since training activities and assessments in a competence-based approach are goal-oriented, trainers focus on clearly defined areas of skills, knowledge and understanding that their own industry has defined in the competence standards. At the same time, trainees are more motivated to learn when they realize the benefits of improved performance.

2. **Efficiency**

   The transfer gap between the training environment and working on the job is reduced substantially in a competence-based approach. This is because training and assessment are relevant to what needs to be done on the job. As a result, it takes less time for trainees to become competent in the required areas. This, in turn, contributes to improved efficiency where training and assessment are concerned.

3. **Increased productivity**

   When trainees become competent in the competence standards that their own industry has defined, when they know what the performance expectations are and receive recognition for their abilities through successful assessments, they are likely to be more motivated and experience higher job satisfaction. The result is improved productivity for organizations. The communication and constructive feedback between future employers and employees will improve as a result of a competence-based approach, which can also increase productivity.

4. **Reduced risk**

   Using a competence-based approach to training, development, and assessment, employers are able to create project teams of people with complementary skills. A trainee's record of the skills, knowledge and understanding relating to the competence standards they have achieved can be used by a future employer to identify and provide further relevant training and assessment for new skills areas. Competence standards can shape employee development and promotional paths within an organization and give employees the opportunity to learn more competencies beyond their roles. It can also provide organizations with greater ability to scale and flex as needed, thereby reducing the risk they face.

5. **Increased customer satisfaction**

   Employees who have been trained and assessed using a competence-based approach are, by the definition of the relevant competence standards, able to perform the required tasks associated with a job. The knock-on effect is that, in service-related industries, they are able to provide high service levels, thereby increasing customer satisfaction. In production or manufacturing industries, they are able to work closely to industry standards in a more effective and efficient way.

Lesson plans

This manual provides a series of lesson plans that will guide delivery of each module for the Dies & Molds maker qualification. It is important for trainers to be flexible and be ready to adapt lesson plans to suit the context of the subject and the needs of their trainees.

Good teachers acknowledge that CBT means each and every trainee in the class learns at a different speed. The good teacher is prepared to throw aside the day's lesson plan and do something different (and unplanned) for the class even if it means 'writing' a lesson plan for each trainee to match their learning pace for that day or week.

Learning by doing is different from learning theory and then applying it. To learn to do something, trainees need someone looking over their shoulder saying 'it's not quite like that, it's like this', 'you do it like this because …', or even 'tell me why you chose to do it like this?'.

In this way, trainees learn that theoretical knowledge is meaningless if it is not seen in the context of what they are doing. In other words, if a trainee doesn't know why they do something, they will not do it competently (skills underpinned by knowledge = competent performer).

This is how a dies & molds maker acquires a practical grasp of the standards expected. It's not by learning it in theory, but because those standards are acquired through correction by people who show what the standards are, and correct the trainee where they do not meet those standards, and where they repeat it correction until they have internalised those standards.

Demonstration of skill

Demonstration or modeling a skill is a powerful tool, which is used, in vocational training. The instructions for trainers for demonstration are as under:

a) Read the procedure mentioned in the Trainer Guide for the relevant Learning Unit before demonstration.
b) Arrange all tools, equipment and consumable material, which are required for demonstration of a skill.
c) Practice the skill before demonstration to trainees, if possible.
d) Introduce the skill to trainees clearly at the commencement of demonstration.
e) Explain how the skill relates to the skill(s) already acquired and describe the expected results or show the objects to trainees.
f) Carry out demonstration in a way that can be seen by all trainees.
g) Use the same tools and materials that the learner will be using.
h) Go through EACH of the steps involved in performing the skill.
i) Go SLOWLY - describe each step as it is completed.
j) Encourage the learners to move around and watch what you are doing from a number of different angles.

k) Identify critical or complex steps, or steps that involve safety precautions to be followed.
l) Explain theoretical knowledge where applicable and ask questions to trainees to test their understanding.
m) Try to involve the learners: Ask them questions about why they think the process may work that way.
n) Repeat critical steps in demonstration, if required.
o) Summarize the demonstration by asking questions to trainees.

Involvement in the process (actively seeing) is important at this stage. When you work on getting involved, getting people to participate, you make them a part of what is happening. Questions for clarification or explanation are important throughout the demonstration. It is up to the learners to ask questions about things they do not understand, but it is also important for trainers to seek out and elicit questions from learners. A trainer may need to do repeated demonstrations of difficult or complex skills.

Overview of the program

Course: Dies & Molds Maker Level 2	**Total Course Duration:** 6 months
Course Overview:	
The purpose of the Dies and Molds Maker course is to engage young people with a programme of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. Upon completion of the Dies and Molds maker qualification, students will be ready to join the workforce with a healthy number of options in the production, manufacturing and light engineering sector. The core purpose of this qualification is to produce employable Dies & Molds maker who could perform relevant operations according to national and international standards. In addition, this qualification will prepare unemployable youth to be employed in the light engineering and manufacturing sector.	

Module	Learning Unit	Duration
Module 1: Maintain Personal Health, Hygiene and safety **Aim:** This Competency Standard identifies the competencies required to protect/apply occupational Safety, Health and Environment at workplace according to the industry's approved guidelines, procedures and interpret environmental rules/regulations. Trainee will be expected to identify and use Personal Protective Equipment (PPE) according to the work place requirements. The underpinning knowledge regarding Observe Occupational Safety and Health (OSH) will be sufficient to provide	**LU1:** Identify Hazard at work place **LU2:** Apply personal protective and safety equipment (PPE. **LU3:** Observe occupational safety and health (OSH) **LU4:** Dispose of hazardous waste/materials	30 hours

Module	Learning Unit	Duration
the basis for the job at workplace.		
Module 2: Perform bench Work **Aim:** This competency standard covers the skills and knowledge required to perform bench work operations including sawing, filing, drilling, taping, reaming, countersinking, counter boring, polishing & grinding.	**LU1:** Perform sawing **LU2:** Perform filing **LU3:** Perform drilling **LU4:** Perform hand taping **LU5:** Perform hand reaming **LU6:** Perform counter boring **LU7:** Perform counter sinking **LU8:** Perform polishing **LU9:** Perform hand grinding **LU10:** Demonstrate safe working conditions & housekeeping	180 hours
Module 3: Perform lathe operations **Aim:** This competency standard covers the skills and knowledge required to perform different processes on lathe machines including facing, turning, parting, threading, knurling, and drilling.	**LU1:** Set tools and lathe machine **LU2:** Perform workpiece setting **LU3:** Perform facing **LU4:** Perform turning **LU5:** Perform thread cutting **LU6:** Perform parting **LU7:** Perform drilling / Boring **LU8:** Perform knurling **LU9:** Perform final inspection **LU10:** Demonstrate safe working practice & housekeeping	200 hours
Module 4: Perform milling operations **Aim:** This competency standard covers the skills and knowledge required to perform different processes on milling machines including pocketing, contouring,	**LU1:** Set tools and milling machine **LU2:** Perform workpiece setting **LU3:** Perform pocketing **LU4:** Perform contouring **LU5:** Perform drilling / boring **LU6:** Perform reaming **LU7:** Perform indexing **LU8:** Perform final inspection **LU9:** Demonstrate safe working practice & housekeeping	180 hours

Module	Learning Unit	Duration
reaming, indexing, and drilling/boring.		
Module 5: Perform grinding operation **Aim:** The standard covers the skills and knowledge needed to perform different type of grinding, which includes surface, cylindrical & tool & cutter grinders.	**LU1:** Set grinding machine **LU2:** Perform work piece setting **LU3:** Perform surface grinding **LU4:** Perform cylindrical grinding **LU5:** Perform final inspection **LU6:** Demonstrate safe working practice & housekeeping	100 hours
Module 6: Perform basic communication skills **Aim:** This competency standard covers the skills and knowledge required to perform basic communication skills	**LU1:** Work in team **LU2:** Follow supervisor's Instructions **LU3:** Demonstrate basic IT skills	30 hours
Module 7: Dispose the waste material **Aim:** This unit involves the skills and knowledge required for disposing of waste which can be a sanitary landfill or any other locally used method	**LU1:** Characterize the final waste **LU2:** Dispose of the final waste	30 hours

Module	Learning Unit	Duration
Module 8: Demonstrate basic numeracy skills **Aim:** This module covers the skills and knowledge required to apply basic Numeracy skills, Perform Measurement, Perform basic mathematical calculations and Calculate Area and Volume of aggregate	**LU1:** Apply basic numeracy skills **LU2:** Perform measurement **LU3:** Perform basic mathematical calculations **LU4:** Calculate Area and Volume of aggregate	50 hours

FORMAT FOR LESSON PLAN			
Module 2: Perform Bench Works			
Learning Unit 1: Perform Sawing			
Methods	Key Notes	Media	Time
	The tools, material and techniques used for preparing workstation for perform sawing		
	Introduction		
	This session will introduce learners to the tools, techniques and material used for perform sawing, using presentation, demonstration, question and answer, and practical skills development.		
	Main Body		
	• How to interpret simple drawing • Different types of hacksaw frames & hacksaw blades • Hacksaw blades of different TPIs and their particular uses • Common types of measuring tools and their uses • Common types of marking tools and their uses • Types of clamping devices used to clamp material during sawing • Correct posture to be maintained to perform sawing		
	Conclusion		
	To conclude the session, review the tools, techniques and material used for perform sawing. Give learners the opportunity to ask questions.		
	Assessment Question and answer, discussion groups with feedback, observation of practice skills development		
			Total time:

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Trainer’s guidelines

Module 1: Maintain Personal Health, Hygiene and Safety			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1:			
Module 2: 071500966 Perform bench works			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**

LU1: Perform Sawing	Deliver an illustrated presentation about interpretation of drawing, measuring & marking tools, clamping devices & correct method to perform sawing. Ensure that the presentation focuses on the following key points: • How to interpret simple drawing • Different types of hacksaw frames & hacksaw blades • Hacksaw blades of different TPIs and their particular uses • Common types of measuring tools and their uses • Common types of marking tools and their uses • Types of clamping devices used to clamp material during sawing • Correct posture to be maintained to perform sawing After the presentation divide the class into two or more groups. Give a simple drawing of a part in which sawing is required to each group. Learners need to work in their groups discussing the drawing that has been allocated to their group. Each group should use a sheet of flip chart paper to record the following. • Clamping device to be used • Which blade TPI to be used for the assigned material • Which measuring & marking tools to be used After the discussion, begin the feedback session. Ask one group to come to the front of the class with their flipchart. Put up the flipchart where it can be easily seen by other learners. Ask the group to share the main points they have recorded. Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers **Sawing Tools/equipment** Hacksaw frame Hacksaw blades Measuring & marking tools Bench vices Flip charts MS Plate for sawing Protective clothing according to job requirements gloves, goggles, safety shoes, helmet

LU2: Perform filing	Deliver an illustrated presentation about metal filing process. Ensure that the presentation focuses on the following key points • Introduction of filing process • Types & classification of files with all aspects • Correct posture to be maintained during filing • Types of clamping devices to be used In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them all types of files and their method of identification Ask the students to write down all the file types with their sketches and write their uses as well on a flip chart and present their working to the class. Demonstrate the filing process on a metal piece to the students ensure that all students can clearly observe the process and the posture, encourage them to ask the questions. Enable learners to practice using the appropriate tools and equipment for perform filing in a controlled environment.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers **Filing Tools/equipment** Different types of files Measuring & marking tools Bench vices Flip charts MS plate for filing Protective clothing according to job requirements gloves, goggles, safety shoes, helmet
LU3: Perform drilling	Begin this session with an illustrated presentation on drilling. Ensure that the presentation addresses the following points, including demonstrations of preparation and methods where appropriate: • Types of drill machines i.e. bench type, pillar type, column type, radial type • Major functional parts of a drill machine. ○ **Parts:** machine head, work table,	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers **Drilling Tools/equipment** Different types of drill machines

	speed pulley, feed lever, spindle / quill, drill chuck, sleeves • Types of drill bits: straight shank and taper shank • Cutting speed of common engineering materials like aluminum, mild steels, cast iron, carbon steels, copper, brass • Calculation method for RPM. • Steps to perform drilling. • Post drilling operations i.e. chamfering, bur removing etc. After presentation, take the students to workshop and make them to identify each part and function of the drill machine Demonstrate them the following key points: • How to operate the drill machine • How to select and set the drill bit • How to set the cutting speed • How to perform drilling Arrange a question and answer session to clarify trainees' understanding. To prepare for the practical sessions, allocate each trainee a drawing and piece of metal and ask them to perform drilling as per drawing enable learners to practice using the appropriate tools and equipment for perform drilling in a controlled environment. Check that each trainee understands their task. After the practical sessions are complete, lead a feedback session. Ask learners to complete a self-assessment form on their ability to perform drilling		Measuring & marking tools Drill bits Spanner set MS Plate for drilling Protective clothing according to job requirements gloves, goggles, safety shoes, helmet

	Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions		
LU4: Perform hand tapping	Deliver an illustrated presentation about hand tapping process. Ensure that the presentation focuses on the following key points: • Type of taping (machine & hand tapping) • Different types of threads • Maintenance of threads • Extraction of tap • Cleaning of threads • Standard procedure of tapping After presentation, demonstrate the above stated competence for better understanding of the trainees. Arrange a question and answer session to clarify trainee understanding. After demonstration allocate each trainee a workpiece and ask them to perform threading by hand tapping as demonstrated Check that each trainee understands their task. Ask learners to complete a self-assessment form on their ability to perform threading Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers **Tapping Tools/equipment** Different types of tap set Measuring & marking tools Clamping device MS workpiece for tapping Protective clothing according to job requirements gloves, goggles, safety shoes, helmet
LU5: Perform hand reaming	Deliver an illustrated presentation about hand reaming process. Ensure that the presentation focuses on the following key points • Types of reamers • Machine reaming • Hand reaming	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers

	• Calculation of drill size w.r.t size of reamer • Tolerance & fits In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them reamers and identification of their sizes Demonstrate the reaming process on a metal piece to the students ensure that all students can clearly observe the process and the posture, encourage them to ask the questions. Allocate each trainee a task to perform reaming and continue monitor that each students has properly understood the method and performed the required job		**Tools/equipment** Different size of reamers set Different size of drill bits Measuring & marking tools Clamping device MS workpiece for reaming Protective clothing according to job requirements gloves, goggles, safety shoes, helmet
LU6: Perform counter boring	Begin this session with an illustrated presentation on counter boring. Ensure that the presentation addresses the following points: • Purpose of counter boring • How to calculate the size of required counter boring tool • Calculation method for required cutting speed • Standard method / steps to perform counter boring • Post drilling operations to be performed After presentation, take the students to workshop and make them to identify different sizes of counter boring tools Demonstrate them how to select tool & perform counter boring operation Arrange a question and answer session to clarify	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers **Counter boring Tools/equipment** Different size of counter boring tool set Different size of HSS drill bits Coolant Measuring & marking tools Clamping device MS workpiece for counter boring Protective clothing according to job requirements gloves, goggles,

	trainees understanding. To prepare for the practical sessions, allocate each trainee a drawing and piece of metal and ask them to perform counter boring as per drawing. Check that each trainee understands their task. After the practical sessions are complete, lead a feedback session. Ask learners to complete a self-assessment form on their ability to perform counter boring Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions		safety shoes, helmet
LU7: Perform counter sinking	Begin this session with an illustrated presentation on countersinking. Ensure that the presentation addresses the following points: • Purpose of countersinking • How to calculate the size of required counter boring tool • Calculation method for required cutting speed • Standard method / steps to perform countersinking • Post drilling operations to be performed After presentation, take the students in workshop and make them to identify different sizes of countersinking tools Demonstrate them how to select & perform countersinking operation Arrange a question and answer session to clarify trainees understanding. To prepare for the practical sessions, allocate each trainee a drawing and piece of metal and ask them	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers **Countersinking Tools/equipment** Different size of countersinking tool set Different size of drill bits Measuring & marking tools Clamping device MS workpiece for countersinking Protective clothing according to job requirements gloves, goggles, safety shoes, helmet

	to perform countersinking as per drawing. Check that each trainee understands their task. After the practical sessions are complete, lead a feedback session. Ask learners to complete a self-assessment form on their ability to perform countersinking Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions		

LU8: Perform polishing	Deliver an illustrated presentation about polishing process. Ensure that the presentation focuses on the following key points
	• Concept of surface finish: radii, peeks etc
	• Polishing aids:
	  ○ Emery cloth
	  ○ Oil stones
	  ○ Polishing abrasive
	  ○ Polishing paste
	  ○ Pin grinding wheels
	  ○ Rotary burs
	  ○ Buffing
	  ○ Lapping
	• Post polishing process
	In the end of the presentation include some multiple choice questions for the feedback of students
	After the presentation take the students to the workshop and make them identify the polishing aids mentioned above.
	Demonstrate the polishing process on a metal piece to the students ensure that all students can clearly observe the process, encourage them to ask the questions.
		Class room / Demonstration room Workshop	Multimedia
			Handouts
			Learner's guide
			White board
			Board markers
			Polishing Tools/equipment
			Hardened carbon steel bar
			Emery clothes rough to fine grades
			Oil stones
			Polishing abrasive
			Polishing paste
			Pin grinding wheel
			Rotary burs
			Pin grinder
			Hand buffing cloth
			Personal protective equipment

	Allocate each trainee a task to perform polishing and continue monitor that each students has properly understood the method and performed the required job		
LU9: Perform hand grinding	Deliver an illustrated presentation on how to perform hand grinding. Ensure you address the importance of the following points: • Different types of grinders & grinding machines • Size and purpose of grinding discs & grinding wheel • Criteria for selection of grinder/grinding wheel/disc as per job specifications • Procedure of mounting the grinding wheel/disc • Safe operating procedure for using portable grinders Prepare either: • A flip chart • A PowerPoint slide • A handout …showing the key topics about perform grinding as mentioned above. Go through all the key topics briefly and then allocate **one key topic** to each group. Learners need to work in their small groups discussing the key topic that has been allocated to their group. Each group should use a sheet of flip chart paper to record **three main points** from their discussions that relate to **their key topic**. After the discussion, begin the feedback session.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers **Grinding tools & equipment** Pedestal grinding machine Hand grinder Grinding disc Pin grinder Pin grinding wheels Personal protective equipment

	Ask one group to come to the front of the class with their flipchart. Put up the flipchart where it can be easily seen by other learners. Ask the group to share the main points they have recorded for their key topic for perform grinding. Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified. Then ask the next group to share their flipchart showing the main points they have recorded for the next key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. Photograph or scan all the flipcharts and use these to create a handout to distribute to all learners. Learners must be able to practice and develop their knowledge and skills relating to perform grinding. Ensure that learners have the opportunity to ask questions to support their understanding		
LU10: Demonstrate safe working conditions & housekeeping	Invite an experienced industrial expert to deliver a presentation on demonstrate safe working conditions & housekeeping. Ensure their presentation addresses the following important points: • Safety hazards associated to a machine shop environment and methods to avoid them • Selection & safe storage of personal protective equipment related to bench work operations • Selection & safe storage of tools related to	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Personal protective equipment

	bench work operations • Importance of maintaining housekeeping at workplace • Incident reporting procedures Display a slide or flip chart with a key question relating to how to maintain housekeeping and safety all the time at workplace **Step 1 – Think** Working on their own, each learner **thinks** about the question and makes notes of their responses or key points which they believe to be important. **Step 2 – Pair** For the next step, each learner **pairs** up with a partner. The two learners exchange their ideas and make further notes to add clarity to their own ideas. **Step 3 – Share** The final step is for you to invite different pairs to share the ideas they have discussed in response to the key question relating to safe working conditions & housekeeping Learners must be able to practice and develop their knowledge and skills relating to safe working conditions & housekeeping. Ensure that learners have the opportunity to ask questions to support their understanding.		

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Module 3: 071500967 Perform lathe operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Set tools & lathe machine	Deliver an illustrated presentation on how to set tools & lathe machine. Ensure you address the importance of the following points: • Different types of lathe machine • Major parts of lathe machine & their function • Different types of cutting tools and their uses • Tool clamping methods • Different types of clamping devices used on lathe machine • Method of setting machine parameters In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and let them identify the different parts of lathe machine. Demonstrate them how to mount the tool & method of setting speed & feed of lathe machine and ask trainees individually to repeat the task Continue monitor that each students has properly understood the method and performed the required job	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Center lathe Vernier caliper External micro meter Internal micrometer HSS tool bit Carbide tips Carbide inserts

LU2: Perform workpiece setting	Deliver an illustrated presentation about how to set work piece on lathe machine. Ensure that the presentation focuses on the following key points: • Workpiece clamping devices: **Devices:** concentric chuck, four jaws chuck, face plate and tail stock, collets. • Use of dial indicators i.e. Dial indicator, lever gauge, magnetic stand. • Methods of workpiece clamping i.e. three jaws chuck, four jaws chuck, between centers, use of face plate etc. • Methods of dialing In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them what are the steps to set the workpiece on lathe machine and how different kind of clamping devices are used for this purpose Ensure that all students can clearly observe the process and encourage them to ask the questions Ask each trainee to perform workpiece setting and continue monitor that each students has properly understood the method.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS shaft Three and four jaws chuck Face plate Driving plate Lathe dog Lathe machine tail stock Collet set Dial indicator with magnetic stand Lever gauge Dead center Revolving center

LU3: Perform facing	Begin this session with an illustrated presentation on facing operation on lathe machine. Ensure that the presentation addresses the following points: • Tool angles and their application for different materials. **Tool angles:** rack angle, clearance angle, wedge angle, face clearance etc. • Different types of tool post and carriage. • Method of calculation & setting of RPM • Understand cutting speed and feed rate After presentation, take the students in workshop and make them to identify different types of tool angles Demonstrate them the following key points: • How to calculate RPM for any specified workpiece • How to set RPM on the lathe machine Arrange a question and answer session to clarify trainees' understanding. To prepare for the practical sessions, allocate each trainee a drawing and piece of shaft and ask them to perform facing as per required size Check that each trainee understands their task well After the practical sessions are complete, lead a feedback session. Ask learners to complete a self-assessment form on their ability to perform facing Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS shaft HSS tool bits Vernier caliper

LU4: Perform turning	Deliver an illustrated presentation about turning process. Ensure that the presentation focuses on the following key points • Process of turning / between center turning • Tool angles and their application for different materials. **Tool angles:** rack angle, clearance angle, wedge angle, face clearance etc. • Different types of tool post and carriage. • Method of calculation & setting of RPM • Understand cutting speed and feed rate In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and demonstrate the turning process on a metal shaft piece to the students ensure that all students can clearly observe the process and encourage them to ask the questions. Allocate each trainee a task to perform turning and continue monitor that each students has properly understood the method and performed the required job	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers HSS tool bit MS shaft External micro meter Vernier Micrometer Dial indicator Revolving center Dead center Driving plate
LU5: Perform thread cutting	Deliver an illustrated presentation on how to perform thread cutting. Ensure you address the importance of the following points: • Different types of threads. **Types:** Metric, British, square, acme, buttress	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers

	• Use & purpose of multi start threads. • Thread cutting procedure. • Thread cutting parameters: lead screw, gear train, feed rate etc. Prepare either: • A flip chart • A PowerPoint slide • A handout …showing the key topics about perform thread cutting as mentioned above. Go through all the key topics briefly and then allocate **one key topic** to each group. Learners need to work in their small groups discussing the key topic that has been allocated to their group. Each group should use a sheet of flip chart paper to record **three main points** from their discussions that relate to **their key topic**. After the discussion, begin the feedback session. Ask one group to come to the front of the class with their flipchart. Put up the flipchart where it can be easily seen by other learners. Ask the group to share the main points they have recorded for their key topic for perform thread cutting. Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified. Then ask the next group to share their flipchart showing the main points they have recorded for the next key topic. Repeat the discussion process.		MS shaft Thread samples Thread cutting tool HSS Thread pitch gauge Vernier Micrometer Dial indicator Revolving center Dead center Driving plate

	Continue until you have covered all the key topics. End the group discussion activity with a summary. Photograph or scan all the flipcharts and use these to create a handout to distribute to all learners. Take the students to workshop and demonstrate how to perform thread cutting. Learners must be able to practice and develop their knowledge and skills relating to perform thread cutting Ensure that learners have the opportunity to ask questions to support their understanding		
LU6: Perform parting	Deliver an illustrated presentation about perform parting on lathe machine. Ensure that the presentation focuses on the following key points: • Process of parting • Tool used for parting & straight parting • Clamping method of parting tool • Machine parameters in parting • RPM setting After the presentation divide the class into two or more groups. Assign a key topic to each group. Learners need to work in their groups discussing the topic that has been allocated to their group. Each group should use a sheet of flip chart paper to record their points. Ask the group to share the main points they have recorded. Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified. Then ask the next group to share their flipchart	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers HSS Parting tool MS shaft Vernier caliper

	showing the main points they have recorded for the next key topic. Repeat the discussion process. Continue until you have covered all the key topics. After the activity demonstrate the complete procedure of parting on lathe machine in front of all students. Ask students to observe all the process specially the correct tool angle. Learners must be able to practice and develop their knowledge and skills relating to parting in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding		
LU7:Perform drilling/boring	Deliver an illustrated presentation on how to perform drilling/boring on lathe machine. Ensure you address the importance of the following points: • The method of using drill chuck on lathe machine • Setting of RPM for workpiece • Clamping method of boring tool • Perform drilling in correct order i.e. center drill, pilot drill and final drill Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for perform drilling / boring on lathe machine. Learners need to work in small groups discussing the key topics. Each group should make notes from their discussions that identify **three main points** that related to **each key topic**. After the discussion, begin the feedback session. Ask	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS shaft HSS boring tool Boring bar Bore gauge Vernier caliper / Internal micrometer Drill chuck Drill bit set Center drill Internal caliper

	one group to share the main points they have recorded for the first key topic. Discuss these main points briefly with the whole group. Learners should make additional notes to record additional points their group had not identified. Then ask the next group to share the main points they have recorded for the second key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. Learners must be able to practice and develop their knowledge and skills relating to perform drilling/boring on lathe machine. Ensure that learners have the opportunity to ask questions to support their understanding. Demonstrate the following activity in the workshop for the students and ensure that students must observe and learn the process • How to clamp boring tool • How to set RPM of machine to required setting • How to perform center drill , pilot drill & final drill Allocate each trainee a practice workpiece and ask them to repeat the process.		

LU8: Perform knurling	Deliver an illustrated presentation about knurling process. Ensure that the presentation focuses on the following key points • Why the knurling is required on any workpiece • Types of knurling i.e. straight and diamond knurling • Different types of knurling tools • Use of dial indicator in knurling In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them some object in which knurling is been done and make them identify the purpose and type of knurling Demonstrate the knurling process on a piece of shaft to the students ensure that all students can clearly observe the process like RPM setting, clamping of tool and carry out the knurling process. Encourage them to ask the questions. Allocate each trainee a task to perform knurling and continue monitor that each students has properly understood the method and performed the required job	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS shaft Knurling tool Lubricant Revolving center

LU9: Perform final inspection	Lead a discussion about why inspection is needed and how to perform final inspection. Use real examples to support the discussion and ensure the discussion considers: • Description of tolerance i.e. upper limits and lower limits, basic hole and shaft system • Types & uses of inspection tools. **Tools:** Ring gauge, plug gauge, thread pitch gauge, internal micrometer, external micrometer, • What is parallelism and process of checking parallelism Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for performing final inspection. Learners need to work in small groups discussing the key topics. Each group should make notes from their discussions that identify **three main points** that related to **each key topic**. After the discussion, begin the feedback session. Ask one group to share the main points they have recorded for the first key topic. Discuss these main points briefly with the whole group. Learners should make additional notes to record additional points their group had not identified. Then ask the next group to share the main points they have recorded for the second key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. Learners must be able to practice and develop their knowledge and skills relating to perform final inspection Ensure that learners have the opportunity to ask questions to support their understanding.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Ring gauge Plug gauge Thread pitch gauge Thread plug gauge Internal and external micrometer Dial indicator with magnetic stand Internal and external caliper

LU10: Demonstrate safe working practice & housekeeping	Lead a brainstorm on ways to demonstrate safe working practice & housekeeping. Use ideas from the brainstorm to explain the following key points: • Hazards associated with performing lathe machine operations • PPEs to be used while working on lathe machine • How to maintain cleanliness & housekeeping • Why should we maintain cleanliness & demonstrate safety all the times Display a flip chart showing the following key question: *'What are the challenges when demonstrate safe working practice and maintain housekeeping?'* Give each learner a sheet of paper and asked them to write their name at the top. Explain to learners that they will be sharing their work with other learners. Ask learners to write silently for 3-5 minutes answering the question displayed on the flip chart. When learners have completed writing, instruct them to pass their paper to the learner on their left. Each learner will read what their partner has passed to them and write a response. This will also be done silently. After another 2-3 minutes, instruct the learners to pass the paper to their left a second time. Repeat the same procedure, also done in silence. At the end of the activity, ask the learners to return the paper to the original writer. Allow learners a few moments to read over the responses to their writing. Ask learners to work in pairs to reflect on and discuss the responses to the question on the flip chart. When this activity is concluded, collect the papers and	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers PPEs

	make copies for each learner. Learners must be able to practice and develop their knowledge and skills relating to demonstrate safe working practice & housekeeping in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding.		

LU1: Set tool & milling machine	Deliver an illustrated presentation about how to set tools & milling machine. Ensure that the presentation focuses on the following key points: • Types of milling machines i.e. vertical, horizontal and universal. • Major functional parts of a milling machine. **Parts:** machine bed, head, speed control lever, bed travel • Types & use of tool clamping devices i.e. collets, long and short arbors etc. • Method of RPM setting, auto feed rate • Types of milling cutters **Types:** End mill, shell end mill, face mill, profile cutters • Uses and types of cutting fluid In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and let them identify the different parts of milling machine & different types of cutter Demonstrate them how to mount the tool & method of setting speed & feed of milling machine and ask trainees individually to repeat the task Continue monitor that each students has properly understood the method and performed the required job	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Milling machine Collet set with adopter Arbors Milling machine cutters Dial indicators
LU2: Perform workpiece setting	Deliver an illustrated presentation about how to set work piece on milling machine. Ensure that the presentation focuses on the following key points: • Workpiece clamping devices:	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide

	Devices: concentric chuck, four jaws chuck, face plate and tail stock, collets. • Use of dial indicators i.e. Dial indicator, lever gauge, magnetic stand. • Methods of workpiece clamping • Methods of dialing In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them what are the steps to set the workpiece on milling machine and how different kind of clamping devices are used for this purpose Ensure that all students can clearly observe the process and encourage them to ask the questions Ask each trainee to perform workpiece setting and continue monitor that each students has properly understood the method		White board Board markers MS plate Machine vice Strap clamp set Parallel block set Dial indicators with magnetic stand Lever type dial indicator Vernier caliper Micrometer Mallets

LU3: Perform pocketing	Deliver an illustrated presentation about perform pocketing on milling machine. Ensure that the presentation focuses on the following key points: • Axis travelling of milling machine • Conventional milling • Climb milling • Workpiece dialing devices like dial indicator & lever gauge After the presentation divide the class into two or more groups. Assign a key topic to each group. Learners need to work in their groups discussing the topic that has been allocated to their group. Each group should use a sheet of flip chart paper to record their points. Ask the group to share the main points they have recorded. Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified. Then ask the next group to share their flipchart showing the main points they have recorded for the next key topic. Repeat the discussion process. Continue until you have covered all the key topics. After the activity demonstrate the complete procedure of pocketing on milling machine in front of all students. Ask students to observe all the process specially the correct tool angle. Learners must be able to practice and develop their knowledge and skills relating to parting in an appropriate practical setting.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS plate Milling cutter Dial indicator with magnetic stand Lever gauge Machine vice Step clamps Parallel blocks Vernier caliper Cutting fluid Slot drill cutter

LU4: Perform contouring	Begin this session with an illustrated presentation on drilling. Ensure that the presentation addresses the following points, including demonstrations of preparation and methods where appropriate: • Different types of contouring & shapes • Types of cutter like ball nose, single lip V tool, grooving tool & radius tool • Standard methods to produce contours through using milling machine After presentation, take the students in workshop and make them to identify each part of and function of the drill machine Demonstrate them the following key points: • How to mount the cutter • How to clamp the workpiece properly • How to perform dialing if required • How to perform contouring Arrange a question and answer session to clarify trainee understanding. To prepare for the practical sessions, allocate each trainee a practice workpiece and ask them to perform contouring as per drawing Check that each trainee understands their task. After the practical sessions are complete, lead a feedback session. Ask learners to complete a self-assessment form on their ability to perform contouring	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS plate Contouring tools Horizontal milling machine Dial indicators with magnetic stand Strap clamps

LU5: Perform drilling / boing	Deliver an illustrated presentation on how to perform drilling/boring on milling machine. Ensure you address the importance of the following points: • Different types of boring tools i.e. boring head, boring bars and their uses • Method of mounting tool on a boring bar and boring head • Method of calculating and setting of boring bar RPM and feed • Work piece clamping devices for milling i.e. machine vice, step clamps, toggle clamps etc. • Safe procedure sequence for boring. Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for perform drilling / boring on lathe machine. Learners need to work in small groups discussing the key topics. Each group should make notes from their discussions that identify **three main points** that related to **each key topic**. After the discussion, begin the feedback session. Ask one group to share the main points they have recorded for the first key topic. Discuss these main points briefly with the whole group. Learners should make additional notes to record additional points their group had not identified. Then ask the next group to share the main points they have recorded for the second key topic. Repeat the discussion process. Continue until you have covered all the key topics.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS plate Drill bits Drill chuck Centre drill Collet set Boring head Boring bar Sleeves HSS tool bit

	End the group discussion activity with a summary. Learners must be able to practice and develop their knowledge and skills relating to perform drilling/boring on milling machine. Ensure that learners have the opportunity to ask questions to support their understanding. Allocate each trainee a practice workpiece and ask them to repeat the process.		
LU6: Perform reaming	Deliver an illustrated presentation about reaming process. Ensure that the presentation focuses on the following key points • Types of reamers • Purpose of using reamers • Tool mounting devices like drill chuck , colle • Machine reaming • Calculation of drill size w.r.t size of reamer • Tolerance & fits • Method of calculation of cutting speed & feed rate In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them reamers and identification of their sizes Demonstrate the reaming process on a metal piece using milling machine to the students ensure that all students can clearly observe the process and the posture, encourage them to ask the questions. Allocate each trainee a task to perform reaming and continue monitor that each students has properly understood the method and performed the required job	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS plate Dial indicator with stand Drill bits Center drill Rose bit Cutting fluid Reamer Plug gauge Pin gauge

LU7: Perform Indexing	Deliver an illustrated presentation indexing methods. Ensure that the presentation focuses on the following key points • Different types of indexing head i.e. producing polygon shapes, gear and their uses • Different types of milling cutters. Types: end mill, shell end mill, face mill, module cutter • Methods of tool clamping i.e. collet, arbor • Dialing methods for indexing • Essential parts of indexing head to perform calculation for indexing i.e. indexing plate, worm wheel, formula, interpretation of answer etc. • Sequence for indexing In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them indexing heads and their identification Demonstrate the process how indexing is performed with different indexing head to the students. Ensure that all students can clearly observe the process and encourage them to ask the questions. Allocate each trainee a task to perform indexing and continue monitor that each students has properly understood the method and performed the required job	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers MS plate or disc Indexing head with tailstock Dial indicator with stand Milling cutter Cutting fluid Vernier caliper

LU8: Perform final inspection	Lead a discussion about why inspection is needed and how to perform final inspection. Use real examples to support the discussion and ensure the discussion considers: • Description of tolerance i.e. upper limits and lower limits, basic hole and shaft system • Types & uses of inspection tools. **Tools:** Ring gauge, plug gauge, thread pitch gauge, internal micrometer, external micrometer, • Post milling operations: deburing, chamfering, cleaning etc. • Use of datum to measure different places. **Datum:** edge datum, surface datum. Point datum, line datum etc. Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for performing final inspection. Learners need to work in small groups discussing the key topics. Each group should make notes from their discussions that identify **three main points** that related to **each key topic**. After the discussion, begin the feedback session. Ask one group to share the main points they have recorded for the first key topic. Discuss these main points briefly with the whole group. Learners should make additional notes to record additional points their group had not identified. Then ask the next group to share the main points they have recorded for the second key topic. Repeat the discussion process. Continue until you have covered	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Workpiece prepared on a milling machine Inspection tools

	all the key topics. End the group discussion activity with a summary. Learners must be able to practice and develop their knowledge and skills relating to perform final inspection Ensure that learners have the opportunity to ask questions to support their understanding.		
LU9: Demonstrate safe working practice & housekeeping	Lead a brainstorm on ways to demonstrate safe working practice & housekeeping. Use ideas from the brainstorm to explain the following key points: • Hazards associated with performing milling machine operations • PPEs to be used while working on milling machine • How to maintain cleanliness & housekeeping • Why should we maintain cleanliness & demonstrate safety all the times Display a flip chart showing the following key question: *'What are the challenges when demonstrate safe working practice and maintain housekeeping specific to milling machine operations?'* Give each learner a sheet of paper and asked them to write their name at the top. Explain to learners that they will be sharing their work with other learners. Ask learners to write silently for 3-5 minutes answering the question displayed on the flip chart. When learners have completed writing, instruct them to pass their paper to the learner on their left. Each learner will read what their partner has passed to them and write a response. This will also be done silently. After another 2-3 minutes, instruct the learners to pass	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers PPEs Milling cutters

	the paper to their left a second time. Repeat the same procedure, also done in silence. At the end of the activity, ask the learners to return the paper to the original writer. Allow learners a few moments to read over the responses to their writing. Ask learners to work in pairs to reflect on and discuss the responses to the question on the flip chart. When this activity is concluded, collect the papers and make copies for each learner. Learners must be able to practice and develop their knowledge and skills relating to demonstrate safe working practice & housekeeping in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding.		
Module 5: 071500969 Perform grinding operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Set grinding machine	Deliver an illustrated presentation about setting of grinding machine. Ensure that the presentation focuses on the following key points: • Types of grinding machines i.e. surface grinding machine and cylindrical grinding machine • Grinding wheel specification and identification through nomenclature • Standard procedure for wheel balancing, mounting and dressing • Types & advantages of using coolant on grinding wheels	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Surface grinding machine Cylindrical grinding machine Grinding wheels Grinding wheel balancing device Diamond dresser

	After the presentation divide the class into two or more groups. Give a simple drawing of a part in which grinding is required to each group. Learners need to work in their groups discussing the drawing that has been allocated to their group. Each group should use a sheet of flip chart paper to record the following • Which grinding wheel to be used Ask the group to share the main points they have recorded. Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified. Then ask the next group to share their flipchart showing the main points they have recorded for the next key topic. Repeat the discussion process. Continue until you have covered all the key topics. After the activity demonstrate the complete procedure of mounting, clamping and grinding in front of all students. Ask students to observe all the process specially the correct posture for cutting Learners must be able to practice and develop their knowledge and skills relating to perform sawing in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding		Ferrous material flat plates and round bars
LU2: Perform workpiece setting	Deliver an illustrated presentation about how to set work piece on grinding machine. Ensure that the presentation focuses on the following key points: • Clamping devices for surface grinding i.e. grinding vice, magnetic table • Clamping devices for cylindrical grinder **Devices:** collets, face plate with dog clamp,	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers

	dead center, revolving center, half center etc • Use of dial indicators i.e. Dial indicator, lever gauge, magnetic stand. • Methods of workpiece clamping • Methods of dialing In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them what are the steps to set the workpiece on grinding machine and how different kind of clamping devices are used for this purpose Ensure that all students can clearly observe the process and encourage them to ask the questions Ask each trainee to perform workpiece setting and continue monitor that each students has properly understood the method		MS shaft Grinding wheel Collet set Faceplate with dog clamp Tailstock Dead center Half center Revolving center Driving plates with driving dogs
LU3: Perform surface grinding	Deliver an illustrated presentation about surface grinding process. Ensure that the presentation focuses on the following key points • Description of grinding machine operational parts i.e. magnetic table, table movement limit switches, feed drum etc. • Knowledge of grinding wheel specification. • Setting of safe table travel length • Advantages of applying coolant on grinding wheels • Safe procedure sequence to perform grinding • Use of rust prevention techniques i.e. oiling	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Surface grinding machine MS plate Grinding wheel Diamond dresser

	greasing etc. • Use of dial indicators for checking parallelism In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them all types of grinding wheels and their method of identification Demonstrate the grinding process on a metal piece to the students ensure that all students can clearly observe the process, encourage them to ask the questions. Allocate each trainee a task to perform surface grinding and continue monitor that each students has properly understood the method.		Micro meter
LU4: Perform cylindrical grinding	Deliver an illustrated presentation about cylindrical grinding. Ensure that the presentation focuses on the following key points: • Major parts of cylindrical machine **Parts:** headstock, tailstock, feed, bed travel limit switch etc. • Grinding wheel specification. • Work holding devices i.e. chuck, collet, between centers etc. • Setting of safe table travel length • Wheel speed and workpiece speed • Advantages of applying coolant on grinding wheels • Safe procedure for operating cylindrical grinders • Use of rust prevention techniques i.e. oiling	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Cylindrical grinding machine Hardened shaft Cylindrical grinder machine accessories Micro meter Lubrication oil Coolant oil Driving plates with driving dogs

	greasing etc. • Use of dial indicators for checking parallelism In the end of the presentation include some multiple choice questions for the feedback of students After the presentation take the students to the workshop and show them what are the steps to set the workpiece on grinding machine and how different kind of clamping devices are used for this purpose Demonstrate them how to perform cylindrical grinding. Ensure that all students can clearly observe the process and encourage them to ask the questions		
LU5: Perform final inspection	Lead a discussion about why inspection is needed and how to perform final inspection. Use real examples to support the discussion and ensure the discussion considers: • Description of tolerance i.e. upper limits and lower limits, basic hole and shaft system • Types & uses of inspection tools. **Tools:** Ring gauge, plug gauge, thread pitch gauge, internal micrometer, external micrometer, Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for performing final inspection. Learners need to work in small groups discussing the	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Micrometer Dial indicator gauge

	key topics. Each group should make notes from their discussions that identify **three main points** that related to **each key topic**. After the discussion, begin the feedback session. Ask one group to share the main points they have recorded for the first key topic. Discuss these main points briefly with the whole group. Learners should make additional notes to record additional points their group had not identified. Then ask the next group to share the main points they have recorded for the second key topic. Repeat the discussion process. Continue until you have covered all the key topics. End the group discussion activity with a summary. Learners must be able to practice and develop their knowledge and skills relating to perform final inspection		
LU6: Demonstrate safe working practice & housekeeping	Lead a brainstorm on ways to demonstrate safe working practice & housekeeping. Use ideas from the brainstorm to explain the following key points: • Hazards associated with performing grinding operations • PPEs to be used while working on grinding machine • How to maintain cleanliness & housekeeping • Why should we maintain cleanliness & demonstrate safety all the times Display a flip chart showing the following key question: *'What are the challenges when demonstrate safe working practice and maintain housekeeping specific to grinding machine operations?'*	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers PPEs Cylindrical grinding machine with all tools and accessories

	Give each learner a sheet of paper and asked them to write their name at the top. Explain to learners that they will be sharing their work with other learners. Ask learners to write silently for 3-5 minutes answering the question displayed on the flip chart. When learners have completed writing, instruct them to pass their paper to the learner on their left. Each learner will read what their partner has passed to them and write a response. This will also be done silently. After another 2-3 minutes, instruct the learners to pass the paper to their left a second time. Repeat the same procedure, also done in silence. At the end of the activity, ask the learners to return the paper to the original writer. Allow learners a few moments to read over the responses to their writing. Ask learners to work in pairs to reflect on and discuss the responses to the question on the flip chart. When this activity is concluded, collect the papers and make copies for each learner. Learners must be able to practice and develop their knowledge and skills relating to demonstrate safe working practice & housekeeping in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding.		

DIES AND MOULDS MAKER

Module-6

TRAINER GUIDE

National Vocational Certificate Level 2

Version 1 - September, 2019

Module 6: <insert module title here>			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
Module 6: <insert module title here>			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1:			
LU2:			
LU3:			
LU4:			

Module 7: <insert module title here>			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1:			
LU2:			
LU3:			
LU4:			

Module 8: <insert module title here>			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1:			
LU2:			
LU3:			
LU4:			

Module 9: <insert module title here>			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1:			
LU2:			
LU3:			
LU4:			

Module 10: <insert module title here>			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1:			
LU2:			
LU3:			
LU4:			

Frequently Asked Questions

1. What is Competency Based Training (CBT) and how is it different from currently offered trainings in institutes?	Competency-based training (CBT) is an approach to vocational education and training that places emphasis on what a person can do in the workplace as a result of completing a program of training. Compared to conventional programs, the competency based training is not primarily content based; it rather focuses on the competence requirement of the envisaged job role. The whole qualification refers to certain industry standard criterion and is modularized in nature rather than being course oriented.
2. What is the passing criterion for CBT certificate?	You shall be required to be declared “Competent” in the summative assessment to attain the certificate.
3. How can I progress in my educational career after attaining this certificate?	You shall be eligible to take admission in the National Vocational Certificate Level-3 in Dies & Molds Maker. You shall be able to progress further to National Vocational Certificate Level-4 in Dies & Molds Maker; and take admission in a level-5, DAE or equivalent course. In certain case, you may be required to attain an equivalence certificate from The Inter Board Committee of Chairmen (IBCC).
4. What is the importance of this certificate in National and International job market?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). These standards are also recognized worldwide as all the standards are coded using international methodology and are accessible to the employers worldwide through NAVTTC website.
5. Which jobs can I get after attaining this certificate? Are there job for this certificate in public sector as well?	Dies and Mold makers are employed in the manufacturing engineering and production sector especially in automobile, house hold goods, electrical and electronics appliances etc. Experienced Dies and mold makers may advance through promotions with the same employer or by moving to more advanced positions with other employers. They can become: • Domestic dies and molds maker

	• Industrial dies and molds maker • Dies and molds maintenance technicians • Machinist • Dies and molds shop foreman • Supervisor • Managers
6. What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the level of supervisor after attaining sufficient experience, knowledge and skills during the job. Attaining additional relevant qualifications may aid your career advancement to even higher levels. Some experienced Dies and molds makers achieve a highly respected level of salaries. There are good prospects for travel both within Pakistan and abroad. The employment outlook in this occupation will be influenced by a wide variety of factors including: • Trends and events affecting overall employment (especially in the manufacturing industry) • Location in Pakistan • Employment turnover (work opportunities generated by people leaving existing positions) • Occupational growth (work opportunities resulting from the creation of new positions that never existed before) • Size of the industry • Flexibility of the applicant (concerning location and schedule of work)
7. Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). The official certificates shall be awarded by the relevant certificate awarding body.

8. Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
9. What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared "Competent" in the summative assessment to attain the certificate.
10. Does this certificate enable me to work as freelancer?	You can start your small business as a Dies & Molds Maker. You may need additional skills on entrepreneurship to support your initiative.

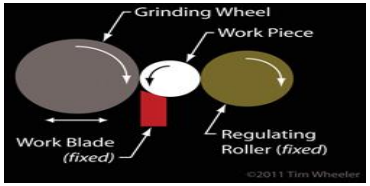
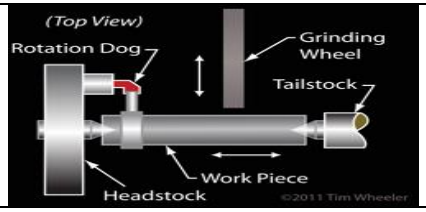
Short Questions/Answers

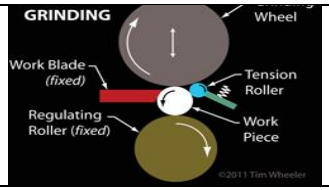
Q1. How many types of hacksaw frames are there? Name them	There are two types of hacksaw frames; fixed and adjustable.
Q2. How many TPI configurations are generally available for hacksaw blades?	There are four TPI configurations: 14 TPI, 18 TPI, 24 TPI and 32 TPI.
Q3. Why do we use marking ink on metals?	Marking ink is used to make the marking visible on a metal surface which otherwise could not be seen properly.
Q4. What is the function of a divider?	Divider is used to mark circular lines or arcs on metals.
Q5. Define V Block?	A vee block (or V-block) is a square or rectangular precision made block used to securely hold a cylindrical workpiece.
Q6. How many types of punches are used in metal working? Name them.	There are two types of punches used: dot punch and center punch
Q7. How many types of files are there as per the cut? Name them.	There are three types of files as per the cut: single cut, double cut and rasp cut
Q8. How do we measure the length of file?	A file's length is measured from the base of its heel to the end of its tip
Q9. How do we change the spindle speed in bench type drill machine?	Variation in spindle speed is achieved by altering the belt position on the stepped pulleys.
Q10. How do we change the spindle speed in pillar type drill machine?	Variation in spindle speed is achieved through a gearbox
Q11. Explain ferrous and non-ferrous metals?	Ferrous metals are those which contain iron as their major element. They are also magnetic and rust prone. Non Ferrous Metals do not contain Iron. These are not magnetic and are corrosion resistant.
Q12. How many types of drill bits are there? Name them.	There are two types of drill bits: straight shank and taper shank.

Q13. What is tapping?	Tapping is the process of cutting a thread inside a hole. Also it is used to make thread on nuts
Q14. How many configurations of hand taps are there? Name them.	Hand taps come in three basic configurations: Taper, Plug and Bottoming.
Q15. How many types of reamers are there? Name them.	There are two types of reamers: machine and hand reamers.
Q16. Define tolerance?	The term tolerance refers to the difference between the upper (maximum) limit and lower (minimum) limit of a dimension. In other words, tolerance is the maximum permissible variation in a dimension.
Q17. What is clearance fit?	A fit that always provides a clearance (gap) between the hole and shaft when assembled is known as clearance fit
Q18. What is the purpose of counter boring?	Counter boring creates a flat-bottom cavity that matches the shape of the underside of a bolt or screw.
Q19. What is the purpose of counter sinking?	Counter sinking creates a conical cavity that matches the angled shape of the underside of a flathead screw.
Q20. Define grinding wheels?	Grinding wheels are expendable wheels composing of an abrasive compound.
Q21. What is cylindrical grinding wheel?	A cylinder wheel is the one which has no center mounting support but has a long & wide surface
Q22. What is tapered grinding wheel?	Tapered Grinding wheel is a straight wheel that tapers externally towards the midpoint of the wheel.
Q23. What is the use of saucer grinding wheel?	Saucer grinding wheel is used for grinding twist drills and milling cutters.
Q24. What is the use of diamond grinding wheel?	This is used to grind hard materials like concrete, gemstones & carbide tips.
Q25. What is PPE?	PPE is personal protective equipment.
Q26. What is a bench lathe?	It is a type of lathe machine that is mounted on a workbench.

Q27. What is a speed lathe?	It is a power lathe with a rapidly revolving spindle used for turning small objects and for polishing purposes.
Q28. What is a turret lathe?	It is a type of lathe machine used for repetitive production of duplicate parts.
Q29. Define headstock?	It is a part of lathe machine that houses the spindle, speed change mechanism and change gears.
Q30. Define tailstock?	Tailstock is usually used to apply support to the longitudinal rotary axis of a workpiece being machined.
Q31. What is the function of lead screw?	The basic function of the lead screw is to move the turret by a précised increment for every rotation of the screw.
Q32. Which type of cutting tool is simplest and most common on lathe machine?	High speed steel (HSS) tool bits are the simplest and most common cutting tools on lathe machine.
Q33. What is tool post?	The tool post clamps the tool holder in the proper positions for machining operations. It is fitted on top slide and carries the cutting tool or the cutting tool holder
Q34. What is a four jaw chuck?	It is a workpiece clamping device that has four jaws used to hold round, square, hexagonal and irregular shaped workpieces.
Q35. What is a face plate?	It is a circular metal workpiece clamping device which fixes to the end of the lathe spindle. The workpiece is clamped to the faceplate using t-nuts in slots in the faceplate or threaded holes in the faceplate itself.
Q36. What is the function of dial indicator?	Dial indicators are used to measure the distance between two surfaces or small amounts of component travel.
Q37. What is a rake angle?	The rake angle is the angle between the front or cutting face of the tool and a line perpendicular to the workpiece.
Q38. What is a clearance angle?	It is the angle between machined surface and the flank surface.
Q39. What is the angle of V shaped thread in metric and british threads?	In metric threads, V has an angle of 60^0 whereas in british threads, V has an angle of 55^0.

Q40. Define parting of workpiece?	Parting uses a blade-like cutting tool plunged directly into the workpiece to cut off the workpiece at a specific length.
Q41. Define knurling?	Knurling is a process of impressing a diamond shaped or straight line pattern into the surface of a workpiece by using specially shaped hardened metal wheels
Q42. What is ring gauge?	A ring gauge is a cylindrical ring whose inside diameter is finished to gauge tolerance and is used for checking the external diameter of a cylindrical object.
Q43. What is the function of thread pitch gauge?	A thread pitch gauge is used to measure the pitch or lead of a screw thread.
Q44. What is internal micrometer?	It is a precision instrument for measuring the inside dimension of an object
Q45. What is external micrometer?	It is used to measure external surfaces of shafts, blocks, spheres and various common shapes.
Q46. Define milling?	Milling is a process performed with a machine in which the cutters rotate to remove the material from the work piece present in the direction of the angle with the tool axis
Q47. Define milling machine bed?	Machine bed or table is a rectangular casting which is present on the top of the saddle. It is used to hold the work or work holding devices.
Q48. What is arbor?	Arbor is a cutting tool holder accessory used in milling machine to clamp the cutting tool.
Q49. Define end mill?	End mill is the milling cutter which has one square end and the outside diameter is smooth for creating smooth surface finishes.
Q50. What is the function of cutting fluid?	The primary function of cutting fluid is temperature control through cooling and lubrication.
Q51. What is the difference between conventional and climb milling?	In Conventional milling the cutter rotates against the direction of the feed whereas during Climb milling the cutter rotates with the feed.

Q52. What is the function of ball nose end mill?	Ball nose end mills are used for milling contoured surfaces, slotting and pocketing.
Q53. Define boring head?	Boring head is an attachment that fits the milling machine spindle and permits most drilled holes to have a better finish and greater diameter accuracy
Q54. Define boring bar?	The boring bar is a machine tool that spins into a part while moving a cutting tool to remove material from the part
Q55. Define indexing?	Indexing is the process of evenly dividing the circumference of a circular work piece into equally spaced divisions
Q56. What is a datum?	A datum is a reference from which measurements are taken.
Q57. What is edge datum?	It is a type of datum which uses a physical surface from which dimensions can be taken.
58. On a grinding disc, a classification code is written. What does the first letter of the code indicate? 	The first letter of the code indicates the type of abrasive used on the wheel
Q59. Write down the type of grinding process used?	Centerless grinding is used in the given figure.
Q60. Write down the type of grinding process used? 	Between center grinding is used in the given figure.

Q61. Write down the type of grinding process used?		Perimetric grinding is used in the given figure.

Test Yourself (Multiple Choice Questions)

MODULE	**2**			
Question	**1**	Compare to flexible hacksaw blades the rigid blades cut material?	A	Less efficient
			B	More efficient
			C	Equally
			D	No remarkable difference
Question	**2**	For a Hacksaw Blade TPI stands for?	A	Teeth Per inch
			B	Thread Per Inch
			C	Tetra Pack International
			D	Transparent Product Identity

Question 3 14 TPI blade is best option to cut?

A Thin sheets

B Thin material

C Wood

D Thickest material

Question 4 The Point angle of center punch is?

A 55º

B 60º

C 90º

D 75º

Question 5 The Point angle of dot punch is?

A 55º

B 60º

C 90º

D 75º

Question 6 The Divider is used to Mark?

A Arc, circle and radius

B Straight lines

C Angular lines

D Irregular shapes

Question 7 V-Blocks are used to clamp?

A Long bars

B Flexible sheets

C Round bars

D Angle iron

Question 8 :Smooth files are used for?

A Polishing

B Finishing

C Roughing

D Material removing

Question 9 The Materials having Iron content are called?

A Non- ferrous metal

B Ferrous metal

C Brass

D Copper

Question 10 Copper is a _____ metal?

A Non- ferrous metal

B Ferrous metal

C Cast

D rough

Question 11 Taps are used to Produce?

A External thread

B Finish hole

			C	Internal threads
			D	chamfer
MODULE	**3**			
Question	**12**	The simplest and most common Material for a lathe tool is?	A	High Carbon HC
			B	High Speed Steel HSS
			C	Brazed Tip
			D	Chromium steel
Question	**13**	On a lathe machine the depth of cut and feed is given through?	A	Lead screw
			B	Carriage

C Tail stock

D spindle

Question 14 The device on lathe machine carriage used to clamp tool is known as?

A Chuck

B Collet

C Tool post

D Face plate

Question 15 Dial indicators are mostly used with a-----?

A Shaft

B Magnetic stand

C Tailstock

D collet

Question 16 The surface of a cutting tool tip over which the removed chips flow is known as?

A Rack angle

B Clearance angle

C Front clearance

D Back clearance

Question 17 RPM stands for?

A Revolutions Per Minute

B Required Per man

C Required Per Million

D Request Per Machine

Question 18 The V angle for British threads is?

A 55º

B 60º

C 90º

D 75º

Question 19 The V angle Matric threads is?

A 55º

B 60º

C 90º

D 75º

Question 20 The angle for Square threads is?

A 55º

B 60º

C 90º

D 75º

MODULE	4		
Question	**21**	In a Milling machine end mill cutters are usually clamped with?	A Chuck
			B Collet
			C Arbors
			D Long bar
Question	**22**	In RPM calculation formula D represents?	A Dia of Collet
			B Dia of arbors
			C Dia of cutting tool
			D Dia of machine spindle
Question	**23**	the tool shown in the figure is a?	A End mill cutter
			B Face mill cutter

C Shell end mill cutter

D Profile cutter

Question 24 The drawing showing three views of an object at 30 degree is called?

A Square view

B ISO matric view

C Orthographic view

D Cabinet view

Question 25 The drawing showing two dimensional view is known as?

A Square view

B ISO matric view

C Orthographic view

D Cabinet view

Question 26 In a milling operation the cutter rotates against the direction of the feed is known as?

A Climb milling

B Conventional Milling

C Cross milling

D End milling

Question 27 In a milling operation the cutter rotates in the direction of the feed is known as?

A Climb milling

B Conventional Milling

C Cross milling

D End milling

Question 28 Reamers are used to maintain?

A Roundness

B Tolerance

C Surface finish

D All of above

MODULE	**5**			
Question	**29**	The machine process uses abrasives is known as?	A	Grinding
			B	Reaming
			C	Boring
			D	Sinking
Question	**30**	Aluminum Oxide wheel are mostly used to grind?	A	Coppers
			B	Aluminum
			C	Steel and steel alloys
			D	Cast Iron

Question 31 In a Grinding wheel classification code “A16R5BS4” Number 16 represents?

A Wheel size

B Grit size

C Wheel Thickness

D Bond thickness

Question 32 Prior to use a grinding wheel it must be?

A Tight

B Balanced

C Mark date

D Mark material

Question 33 In a surface grinding machine the bed traveling is controlled through?

A sensors

B Programmed tool

C Limiting switches

D bell

Multiple Choice Questions Answer scheme

MODULE	2			
Question	**1**	Compare to flexible hacksaw blades the rigid blades cut material?	B	More efficient
Question	**2**	For a Hacksaw Blade TPI stands for?	A	Teeth Per inch
Question	**3**	14 TPI blade is best option to cut?	D	Thickest material
Question	**4**	The Point angle of center punch is?	C	90º
Question	**5**	The Point angle of dot punch is?	B	60º
Question	**6**	The Divider is used to Mark?	A	Arc, circle and radius
Question	**7**	V-Blocks are used to clamp?	C	Round bars
Question	**8**	:Smooth files are used for?	B	Finishing
Question	**9**	The Materials having Iron content are called?	B	Ferrous metal
Question	**10**	Copper is a _____ metal?	A	Non- ferrous metal
Question	**11**	Taps are used to Produce?	C	Internal threads

MODULE	3			
Question	**12**	The simplest and most common Material for a lathe tool is?	B	High Speed Steel HSS
Question	**13**	On a lathe machine the depth of cut and feed is given through?	B	Carriage
Question	**14**	The device on lathe machine carriage used to clamp tool is known as?	C	Tool post
Question	**15**	Dial indicators are mostly used with a-----?	B	Magnetic stand
Question	**16**	The surface of a cutting tool tip over which the removed chips flow is known as?	A	Rack angle
Question	**17**	RPM stands for?	A	Revolutions Per Minute
Question	**18**	The V angle for British threads is?	A	55º
Question	**19**	The V angle Matric threads is?	B	60º
Question	**20**	The angle for Square threads is?	C	90º
Question	**21**	In a Milling machine end mill cutters are usually clamped with?	B	Collet
Question	**22**	In RPM calculation formula D represents?	C	Dia of cutting tool
Question	**23**	the tool shown in the figure is a?	B	Face mill cutter

Question	**24**	The drawing showing three views of an object at 30 degree is called?	B	ISO matric view
Question	**25**	The drawing showing two dimensional view is known as?	C	Orthographic view
Question	**26**	In a milling operation the cutter rotates against the direction of the feed is known as?	B	Conventional Milling
Question	**27**	In a milling operation the cutter rotates in the direction of the feed is known as?	A	Climb milling
Question	**28**	Reamers are used to maintain?	D	All of above
MODULE	**5**			
Question	**29**	The machine process uses abrasives is known as?	A	Grinding
Question	**30**	Aluminum Oxide wheel are mostly used to grind?	C	Steel and steel alloys
Question	**31**	In a Grinding wheel classification code “A16R5BS4” Number 16 represents?	B	Grit size
Question	**32**	Prior to use a grinding wheel it must be?	B	Balanced
Question	**33**	In a surface grinding machine the bed traveling is controlled through?	C	Limiting switches

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