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DIES AND MOULDS MAKER

TRAINER GUIDE

National Vocational Certificate Level 3

Version 1 - August, 2019

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DIES AND MOULDS MAKER

TRAINER GUIDE

National Vocational Certificate Level 3

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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 Makers Level 3	**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: **Aim:**	**LU1:** **LU2:** **LU3:** **LU4:** **LU5:** **LU6:**	
Module 2: Perform EDM operations **Aim:** This module describe the performance out comes, skills and knowledge required to perform electric discharge machine .it cover job setting up, running EDM related simulation making and cavities from the	**LU1:** Set electrode **LU2:** Set workpiece **LU3:** Set machine parameters **LU4:** Set flushing **LU5:** Carryout machining process **LU6:** Perform final inspection **LU7:** Demonstrate safe working practice and housekeeping	100 hours

Module	Learning Unit	Duration
machine		
Module 3: Perform Wire cut operation **Aim:** This Competency Standard identifies the competencies you need to be competent in CNC wire cut operation in accordance with approval procedure	**LU1:** Set machine programing **LU2:** Set wire **LU3:** Set Di-electric attachment **LU4:** Set machine parameters according to the job **LU5:** Carryout machining process **LU6:** Perform final inspection **LU7:** Demonstrate safe working practice & housekeeping	130 hours
Module 4: Perform CNC lathe machine **Aim:** This competency standard covers the skills and knowledge required to operate CNC lathe machine safely	**LU1:** Set machine programing **LU2:** Set tool **LU3:** Set workpiece **LU4:** Carryout machining process **LU5:** Perform final inspection **LU6:** Demonstrate safe working practice & housekeeping	200 hours
Module 5: Perform CNC milling machine operation **Aim:** This competency standard covers the skills and knowledge required to operate CNC Milling machine safely	**LU1:** Set machine programing **LU2:** Set tools **LU3:** Set workpiece **LU4:** Carryout machining process **LU5:** Perform final inspection **LU6:** Demonstrate safe working practice & house keeping	200 hours

Module	Learning Unit	Duration
Module 6: Perform Heat treatment **Aim:** This standard defines the advanced knowledge, skills and understanding needed to perform heat treatment as per standard procedures	**LU1:** Prepare material for heat treatment **LU2:** Perform stress relieving **LU3:** Perform hardening **LU4:** Perform tempering **LU5:** Perform annealing **LU6:** Perform final inspection **LU7:** Demonstrate safe working practice & housekeeping	80 hours
Module 7:	**LU1:**	

FORMAT FOR LESSON PLAN			
Module: Perform EDM Operations			
Learning Unit: Set Electrode			
Methods	Key Notes	Media	Time
	The tools, material and techniques used for setting electrode for EDM		
	Introduction		
	This session will introduce learners to the tools, techniques and material used for setting electrode in EDM, using presentation, demonstration, question and answer, and practical skills development.		
	Main Body		
	• Working principle and applications of EDM • Inspection of electrode size with respect to roughing and finishing • Different types & uses of electrode materials i.e. copper, graphite, steel • Types & application of electrode mounting tools i.e. electrode holder, collect, oscillating head. • Knowledge of dialing devices i.e. dial indicator, lever gauge, magnetic stand, c clamp for lever gauge etc. • Major functional parts of an EDM. **Parts:** control panel, head, machine bed, di-electric fluid tank, working axis.		
	Conclusion		
	To conclude the session, review the tools, techniques and material used for setting electrode. Give learners the opportunity to ask questions.		
	<u>Assessment</u> Question and answer, discussion groups with feedback, observation of practice skills development		
			Total time:

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Module-1

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Trainer’s guidelines

Module 1:			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1:			
LU2:			
LU3:			
LU4:			

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Module-2

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Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Set electrodes	Deliver an illustrated presentation on how to set electrode on EDM. Ensure you address the importance of the following points: • Working principle and applications of EDM • Inspection of electrode size with respect to roughing and finishing • Different types & uses of electrode materials i.e. copper, graphite, steel • Types & application of electrode mounting tools i.e. electrode holder, collect, oscillating head. • Knowledge of dialing devices i.e. dial indicator, lever gauge, magnetic stand, c clamp for lever gauge etc. • Major functional parts of an EDM. **Parts:** control panel, head, machine bed, di-electric fluid tank, working axis. 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 electric discharge machine & electrodes Demonstrate them how to mount the tool & method of using mounting tools 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 EDM Copper electrode Electrode holder Collet set Oscillating head Dial indicator with magnetic stand C-clamp with lever gauge

Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU2: Set workpiece	Deliver an illustrated presentation about how to set work piece on EDM. Ensure that the presentation focuses on the following key points: • Work holding devices used with EDM i.e. magnetic table, grinding vice, concentric chuck, laminated blocks etc. • Importance & method of dialing work piece • Method of aligning electrode with work piece. • Identification & use of orbicut attachments 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 EDM and how different kind of work holding 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 EDM MS plate Laminated blocks Grinding vice Three jaws & four jaws chuck
LU3: Set machine parameters	Deliver an illustrated presentation on how to set machine parameters on EDM. Ensure you address the importance of the following points: • Description & importance of machine	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board

Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	parameters and its effects. **Parameter:** Amperage, voltage, on time, off time, electrode height, pulse time, flushing • Knowledge of grades of surface textures & how to achieve the desired texture (VDI scale) Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for setting machine parameters on EDM. 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		Board markers EDM

Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	knowledge and skills relating to set EDM parameters. 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 Allocate each trainee a practice workpiece and ask them to repeat the process.		

Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU4: Set flushing	Deliver an illustrated presentation about flushing setting on EDM. Ensure that the presentation focuses on the following key points • Importance of maintaining fluid level in the storage tank • Purpose of flushing • Methods of flushing i.e. injection, suction, through nozzle, through electrode, die electric fluid height limit in tank etc. • Method of setting flushing (external / internal) 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 how to set flushing in EDM And ensure that all students can clearly observe the process like setting the nozzles and setting the control of dielectric flow. 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 EDM Die-electric fluid Flushing nozzles Magnetic stand Electrode with internal flushing supplement
LU5: Carry out machining process	Deliver an illustrated presentation about perform machining on EDM. Ensure that the presentation focuses on the following key points:	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide

Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	• Grades of surface finish on EDM (use of VDI scale) • EDM operating techniques / tips • Importance of pulsation time. • Safe operating procedure for EDM 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 machining on EDM in front of all students. Ask students to observe the whole process specially the parameter setting. Learners must be able to practice and develop their knowledge and skills relating to EDM machining in an appropriate practical setting.		White board Board markers EDM MS plate Copper electrode VDI scale

Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU6: 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, VDI Scale • Use of datum to measure different places. **Datum:** edge datum, surface datum. Point datum, line datum etc. • Knowledge of inspection method i.e. measurement techniques, sampling techniques 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	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Vernier caliper Micrometer Dial indicator Lever gauge VDI scale

Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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.		
LU7: 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 EDM shop • Health and safety relevant to EDM shop • Knowledge of classes of fire. i.e. A, B, C and D class. • Advantages of good ventilation in a EDM room. Display a flip chart showing the following key question: *'What are the challenges when demonstrate safe working practice and maintain housekeeping specific to EDM operations?'*	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers PPEs

Module 2: 071500970 Perform Electric Discharge Machine (EDM) Operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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.		

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Module-3

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Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Set machine programing	Deliver an illustrated presentation about set programing of wire cut machine. Ensure that the presentation focuses on the following key points: • Working principle and applications of Wire cut machine • Major functional parts of a wire cut machine **Parts:** bed, head, control panel, wire drum etc • Use of CAD to generate 2D drawing • Preparing drawing for machining i.e. allocate start / end points, adding wire offset values, save in machining format, import export drawing, loading file on machine etc. • Knowledge of setting machine parameters i.e. current, voltage, on time, off time etc. After the presentation divide the class into two or more groups. Give a key topic to discuss and note their main 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 setting machine programming on wire cut machine	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Computer with CAD software CNC wire cut machine 2D drawing for a specific job to cut Portable storage device

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	Ask students to observe all the process specially the correct setting of wire. 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		

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU2: Set wire	Deliver an illustrated presentation about how to set wire on wire cut machine. Ensure that the presentation focuses on the following key points: • Material, diameter and application of wire. **Material:** Molybdenum alloy, Brass, copper **Diameter**: 0.1, 0.15, 0.18, 0.2 mm • Method of winding wire on drum. • Method of tensioning the wire • Method of setting vertical alignment of wire 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 wire on wire cut machine and how different kind of tools 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 wire 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 Wire cut machine Wire loop Wire aligning block Magnet blocks
LU3: Set di electric fluid attachment	Lead a discussion about what is the purpose of di electric fluid in wire cut operation. Use real examples to support the discussion and ensure the discussion considers:	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	• Work holding devices used for wire cut machine • Function of Di-electric fluid • Setting of flushing nozzles Prepare either: • A flip chart • A PowerPoint slide • A handout …showing key topics for setting dielectric fluid attachment. 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 set di electric fluid.		White board Board markers Wire cut machine Di-electric fluid Flushing nozzles with magnetic stand

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	Ensure that learners have the opportunity to ask questions to support their understanding.		
LU4: Set machine parameters according to job	Deliver an illustrated presentation about setting machine parameters of wire cut machine. Ensure that the presentation focuses on the following key points: • Knowledge of wire cut machine parameters and its effects. **Parameter:** On time, off time, current etc. • Machine coordinates (Axis difference in drawing and machine) • Effects of current, on time, off time etc. on the surface finish. 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.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Wire cut machine MS work piece

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	After the activity demonstrate the complete procedure of pocketing on milling machine in front of all students. Ask students to observe all the process. Learners must be able to practice and develop their knowledge and skills relating to set machine parameters of wire cut machine in an appropriate practical setting.		
LU5: Carry out machining process	Begin this session with an illustrated presentation on wire cut machining process. Ensure that the presentation addresses the following points: • Working principle of a wire cut machine • Method of setting wire outside or inside the work piece. • Method of resetting wire due to wire breakage • Safe operating procedure for operating a wire cut machine. After presentation, take the students in workshop and make them to identify different parts of wire cut machine Demonstrate them how to set the wire, di electric fluid and start the machining process 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 produce the required cavity through wire cut machine	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Wire cut machine MS / hardened carbon steel Wire aligning block Wire Di-electric fluid

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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 carry out machining process on wire cut machine Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions		
LU6: 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: • Interpretation of drawing • 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 Inspection tools Flip charts Wire cut drawing Finished piece manufactured through wire cut machine

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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.		
LU7: Demonstrate safe working practice and 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 wire cut machine operations	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers PPEs

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	• Selection & safe storage of tools related to wire cut machine 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.		

Module 3: 071500971 Perform Wire cut operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**

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Module 4: 071500972 Perform CNC lathe operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Set machine programing	Deliver an illustrated presentation about how to set machine program in CNC lathe. Ensure that the presentation focuses on the following key points: • Working principle and applications of CNC lathe machine • Interpretation of drawing • Introduction of programing software Software: CAD CAM (i.e Master CAM, Creo) • Effect of speed, feed, depth of cut etc. • Programing with G and M codes • Method and advantage of test run the machine • Program editing methods • How to save a program 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 CNC lathe machine and the control panel through which the program is loaded in the machine Demonstrate them how to feed the program on CNC 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 CNC lathe machine Computer station with required software

Module 4: 071500972 Perform CNC lathe operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU2: Set tools	Deliver an illustrated presentation about how to set tools on CNC lathe machine. Ensure that the presentation focuses on the following key points: • Purpose of using pneumatic / hydraulic pressure and coolant. • Types of lathe machine tools and their application **Tools:** turning, facing, boring, threading and parting • Method of setting tools on turret. 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 set the tools on CNC lathe machine and how different kind of tools are clamped on turret. Ensure that all students can clearly observe the process and encourage them to ask the questions Ask each trainee to perform tool 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 CNC lathe machine Carbide inserts with holder Threading tool Boring tool Parting tool Turning tool
LU3: Set workpiece	Deliver an illustrated presentation about setting workpiece on CNC lathe machine. Ensure that the presentation focuses on the following key points:	Class room / Demonstration room Workshop	Multimedia Handouts

Module 4: 071500972 Perform CNC lathe operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	• Method of dialing the workpiece. • Standard procedure for workpiece zero setting. • Setting of machining parameters i.e. speed, feed depth of cut etc. • Impact of machine parameters on machining 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 work piece setting on CNC lathe machine in front of all students. Ask students to observe all the process Learners must be able to practice and develop their knowledge and skills relating to workpiece setting on CNC lathe machine in an appropriate practical setting.		Learner's guide White board Board markers CNC lathe machine MS shaft

Module 4: 071500972 Perform CNC lathe operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU4: Carryout machining process	Deliver an illustrated presentation about carry out machining process on CNC lathe machine. Ensure that the presentation focuses on the following key points • Methods and objectives of feed, speed and override • Method of machine execution i.e. single block or Auto • CNC lathe machine operation sequence and practice 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 machining process on a metal piece using CNC lathe 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 CNC lathe machine MS / Aluminum shaft Lathe machine tools
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	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board

Module 4: 071500972 Perform CNC lathe operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	lower limits, basic hole and shaft system • Types & uses of inspection tools. **Tools:** Ring gauge, plug gauge, thread pitch gauge, internal micrometer, external micrometer, • 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 all the key topics. End the group discussion activity with a summary.		Board markers Workpiece prepared on a CNC lathe machine Inspection tools

Module 4: 071500972 Perform CNC lathe operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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.		
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 CNC lathe machine operations • PPEs to be used while working on CNC 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 specific to CNC lathe 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	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers PPEs

Module 4: 071500972 Perform CNC lathe operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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-5

TRAINER GUIDE

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Module 5: 071500973 Perform CNC milling operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Set machine programming	Deliver an illustrated presentation about setting of program in CNC milling machine. Ensure that the presentation focuses on the following key points: • CNC milling / VMC applications • Major functional parts of CNC milling / VMC machine • Machine axis traveling concept i.e. right hand rule. • Tool types and profile • G & M code programing concept for milling operations • Tool path generation according to profile • Method of performing post processing of program. • How to test run the program. • How to edit the program • How to save the program After the presentation divide the class into two or more groups. Give 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 discussion 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.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers CNC milling machine Job drawing for milling Computer with CNC programing software.

Module 5: 071500973 Perform CNC milling operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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 loading, editing and test run the program in front of all students. Ask students to observe all the process. Learners must be able to practice and develop their knowledge and skills relating to set machine programing in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding		

Module 5: 071500973 Perform CNC milling operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU2: Set tools	Deliver an illustrated presentation about how to set tools on CNC milling machine. Ensure that the presentation focuses on the following key points: • Purpose of using pneumatic pressure and coolant • Description of milling machine operations & tools. **Operations:** facing, side milling, pocketing, grooving, contouring, chamfering etc. **Tools:** end mill, shell end mill, face mill, ATC (automatic tool changer), boring bars, removable carbide tips and holders etc. 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 tools on CNC 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 tool 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 CNC milling machine / Machining center Milling cutters

Module 5: 071500973 Perform CNC milling operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU3: Set workpiece	Deliver an illustrated presentation about workpiece setting process. Ensure that the presentation focuses on the following key points • Dialing and zero setting techniques • Method of calculating offset values and setting the values in machine control unit • Method of calculating offset values and feeding in machine parameter. • Method of setting zero for workpiece • Description & purpose of touch probe 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 different types of workpiece and their method of clamping Demonstrate the workpiece setting process 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 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 CNC machine MS plate Hydraulic vice Dial indicator with magnetic stand Center fixture

Module 5: 071500973 Perform CNC milling operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU4: Carryout machining process	Deliver an illustrated presentation on carryout machining process on CNC milling machine. Ensure that the presentation focuses on the following key points • Method of setting home position • Difference between feed rate, cutting speed and override • Deference between single block and auto execution mode • Other miscellaneous functions of CNC milling machine 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 different controls & setting of CNC milling machine Demonstrate the process how machining is performed with different parameters 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 CNC milling operation according to the given drawing 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 Job drawing Aluminum plate Hydraulic vice Milling cutter Cutting oil Single cut flat file
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:	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide

Module 5: 071500973 Perform CNC milling operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	• 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, • 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 all the key topics.		White board Board markers Workpiece prepared on a CNC milling machine Inspection tools

Module 5: 071500973 Perform CNC milling operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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.		
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 CNC milling machine operations • PPEs to be used while working on CNC 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 CNC 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	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers PPEs

Module 5: 071500973 Perform CNC milling operations			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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

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Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Prepare material for heat treatment	Deliver an illustrated presentation on how to prepare material for heat treatment. Ensure you address the importance of the following points: • Heat treatment process steps i.e. deburing, wiring, furnace temperature setting, use of charcoal, socking time, quenching etc. • Workpiece holding method before and after putting into furnace. • Setting of work piece into furnace Prepare either: • A flip chart • A PowerPoint slide • A handout …showing the key topics about preparation of material for heat treatment 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	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Heat treatment furnace Carbon steel block Steel wire Charcoal Plier Steel tray

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	seen by other learners. Ask the group to share the main points they have recorded for their key topic for prepare material for heat treatment. 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. Take the students to workshop and demonstrate how to prepare material for heat treatment. Learners must be able to practice and develop their knowledge and skills relating to prepare material for heat treatment Ensure that learners have the opportunity to ask questions to support their understanding		
LU2: Perform stress relieving	Deliver an illustrated presentation about perform stress relieving. Ensure that the presentation focuses on the following key points: • Introduction to heat treatment processes. **Process:** stress relieving, annealing, hardening, tempering and normalizing.	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	• Description of Iron carbon diagram for setting temperature according to material composition • Importance & setting soaking time on furnace • Method of handling workpiece after heating in a furnace 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 stress relieving 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 perform stress relieving in an appropriate practical setting. Ensure that learners have the opportunity to ask questions to support their understanding		Machined steel block Steel wire Charcoal Steel tray furnace

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU3: Perform hardening	Deliver an illustrated presentation about hardening process. Ensure that the presentation focuses on the following key points • Required hardening temperature as per material specifications • Method of preparing workpiece for hardening • Knowledge of quenching media and its temperature for a heat treatment process • Description of Time Temperature Transformation (TTT) Diagram • Different types of quenching media and their effects. **Types:** water, oil. Brine etc. **Effects:** cracks, stresses etc. • Method of calculating soaking time. • Method of quenching • Method of testing hardness. **Method:** Rockwell (A,B,C scale), Vickers, brinell. etc 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 hardening process on a carbon steel block to the students ensure that all students can clearly observe all the steps. Encourage them to ask the questions. Allocate each trainee a task to perform hardening and continue monitor that each students has properly	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Carbon steel block Furnace Steel wire Charcoal Steel tray Quenching media Tong

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	understood the method and performed the required job		
LU4: Perform tempering	Deliver an illustrated presentation about how to perform tempering. Ensure that the presentation focuses on the following key points: • Mechanical properties of steels **Properties**: ductility, malleability, hardness, tempering, elasticity, plasticity, brittleness, toughness etc. • Temperature range for tempering • Soaking time for tempering • Cooling rate effects on a heated parts i.e. slow cooling and fast cooling. • Method of testing tempered hardness. 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 perform tempering Ensure that all students can clearly observe the process and encourage them to ask the questions Ask each trainee to perform the tempering process 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 Carbon steel block Tempering Furnace Steel wire Steel tray Tempering bath Tong Set Wire cutter Plier Flat file

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU5: Perform annealing	Deliver an illustrated presentation about perform annealing. Ensure that the presentation focuses on the following key points: • Introduction of stress, strain diagram. • Annealing temperature requirement as per material composition • Method of preparing a workpiece for annealing • Soaking time, its effect and method of calculating of soaking time for annealing • Method of cooling and effects of cooling rate on material • Grain structures for fully annealed and hardened material 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	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Carbon steel block Furnace Steel wire Charcoal Steel tray Quenching media

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	of annealing step by step in front of all students. Ask students to observe all the process. Learners must be able to practice and develop their knowledge and skills relating to perform annealing in an appropriate practical setting		
LU6: 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: • Preparation of heat treated workpiece for inspection • Defects associated with heat treatment. i.e cracks, geometric deformation and distortion etc. • Different types of hardness testing tools i.e. hardness tester, conversion charts, indenters etc. • Calibration of a hardness tester machine • Hardness testing methods. **Method:** Rockwell (A, B, C scale), Vickers, brinell. 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	Class room / Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Hardened steel piece Hardness tester Calibration block Diamond tip 120 degree

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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.		

LU7: 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:
	• Use of PPEs
	  ○ Flame retardant Apron
	  ○ Face Mask
	  ○ Long Sleeve Leather Gloves
	  ○ Safety Shoes
	• Safe Procedures for Heat Treatment
		Class room / Demonstration room Workshop	Multimedia
			Handouts
			Learner's guide
			White board
			Board markers
			
			Flame retardant Apron

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	• 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 heat treatment 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 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		Face Mask Long Sleeve Leather Gloves Safety Shoes

Module 6: 071500974 Perform heat treatment			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
	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.		

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Module-7

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

DIES AND MOULDS MAKER

Module-8

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

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Module-9

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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:			

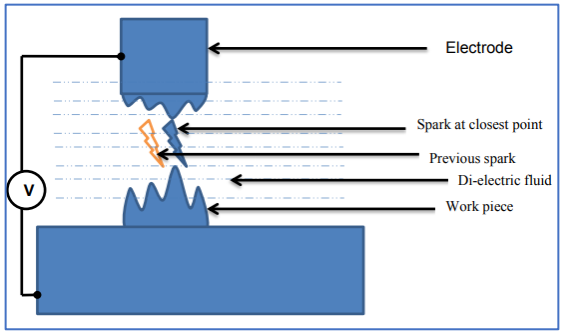
Frequently Asked Questions

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	On-the-job training is not a requirement for final / summative

yes, what is the duration of on-the-job training?	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:

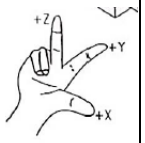
What is abbreviation of EDM	The abbreviation of EDM is " Electrical Discharge Machine"
What is working Principle of EDM?	EDM is a thermal process i.e. material is removed by heat. When electrode is brought closer to the work piece, sunk in the dielectric fluid, current is passed to the electrode and the work piece, which generates heat in the form of frequent series of sparks that vaporizes the pieces at the closest point of work piece and electrode. After removing the piece at the closest distance between electrode and work piece, the next spark occurs simultaneously at the next closest point between them and so on. This process results on forming a cavity on the work piece with the shape of the electrode.
Explain EDM working principle with the help of diagram.	
Write applications of EDM machine.	Generally EDM is hugely used for machining burr free intricate shapes as well as narrow slots and blind cavities. Sinking of dies, plastic molding, die casting compacting, cold heading, extrusion, press tools, wire drawings are some of the examples of its application
Write at least three characteristics of electrode material for EDM.	• High electrical conductivity • High thermal conductivity • Higher density

	• High melting point • Easy manufacturability • Cost efficient
Write down major functional parts of an EDM.	An EDM machine has following major aspects. • Controlled axis • Electrical generator • Control panel • Work table • Dielectric fluid container
Write at least three hazard associated with EDM.	• Hazardous smoke, vapors, and aerosols • Decomposition products and heavy metals • Hydrocarbon dielectrics affect the skin. • Sharp-edge metallic particles damages the skin • Possible fire hazard and explosions • Electromagnetic radiation
Describe classes of fire?	• Class A • Class B • Class C • Class D
Write at least three applications of Wire cut.	• Aerospace, Medical, Electronics and Semiconductor applications • Tool & Die making industries. • For cutting the hard Extrusion Dies • In making Fixtures, Gauges & Cams • Cutting of Gears, Strippers, Punches and Dies

	• Manufacturing hard Electrodes.
How to prepare drawing for a wire cut machining process?	• allocate start / end points, • adding wire offset values, • save in machining format, • import export drawing, • loading file on machine
ON what factors the performance of the wire-tool depends?	• Electrical properties of the wire electrode, • Mechanical properties of the wire electrode, • Thermo Physical properties of the wire electrode, • Cross sectional size and shape of the wire electrode.
Define polarity in terms of Wire cut.	Polarity refers to the electrical conditions determining the direction of the current flow relative to the electrode. The polarity of the electrode can be either positive or negative. Depending on the application, some electrode/work metal combination gives better results when the polarity is changed. Generally the graphite, a positive electrode gives better wear condition and negative gives better speed.
Define duty factor in terms of wire cut?	This is an important parameter in the EDM process. This is given by the ratio of the ON time to the total time. If we have a high duty factor then the flushing time is very less and this might lead to the short circuit condition. A small duty factor indicates a high off time and low machining rate. Therefore there has to be a compromise between the two depending on the tool used, the workpiece and the conditions prevailing.
Define CNC machines	Computer Numeric Control (CNC) is the automation of machine tools that are operated by precisely programmed commands encoded on a storage medium (computer

	command module, usually located on the device) as opposed to controlled manually by hand wheels or levers, or mechanically automated by cams alone. Most NC today is computer (or computerized) numerical control (CNC), in which computers play an integral part of the control.
Describe CNC system Elements?	A typical CNC system consists of the following six elements • Part program • Program input device • Machine control unit • Drive system • Machine tool
Define principle views in orthographic projection	There are six principal views in a multi-view orthographic projection. These are the front, back, top, bottom, and left- and right-side views. A drawing can have any combination of views but the three most common views are: • Front view • Side view • Top view.
Define First angle Projection?	First-angle projection places the object on the profile plane with the vertical plane on the left and the horizontal plane on the bottom. This position locates the top view below the front view, the right-side view on the left side of the front view, and the bottom view above the front view. Because the positioning of the views

	initially seems illogical, first-angle projections is mostly used in asain countries.
Define 3rd angle Projection?	Third-angle projection places the object with the front view projected onto the vertical plane, the top view onto the horizontal plane, and the right-side view onto the profile plane. The arrangement of the three views on paper is logically sequenced. Since the late 1800s, third-angle projection has been the American standard in drafting practice.
Define cutting speed and feed?	**Cutting speed:** The rate of metal removal is from the metal surface, in length, during the machining per unit time. The unit for cutting speed is m/minute. The depth of cut, the feed rate and the cutting speed are dependent of the hardness of the cutting tool material and the hardness of the cutting material: **Feed**: The distance travels by the tool toward the work piece during one rotation of part. Cutting speed and feed determines the surface finish, power requirements, and material removal rate.
Define G code in CNC programing	Codes that begin with 'G' are called preparatory words because they prepare the machine for a certain type of motion.
Define M code in CNC programing	Control machine auxiliary options like coolant and spindle direction. Only one **M-code** can appear in each block of code.

Define F, S and T codes in CNC programing?	• F-code: used to specify the feed rate • S-code: used to specify the spindle speed • T-code: used to specify the tool identification number associated with the tool to be used in subsequent operations.
Describe at least three input devices for CNC milling	• Floppy Drive • USB Flash Drive • Serial Communication • Ethernet Communication • Conversational Programming
Define data processing unit in CNC milling?	On receiving a part program, the DPU firstly interprets and encodes the part program into internal machine codes. The interpolator of the DPU then calculate the intermediate positions of the motion in terms of BLU (basic length unit) which is the smallest unit length that can be handled by the controller. The calculated data are passed to CLU for further action.
Define right hand rule for Cartesian coordinate system.	 The Cartesian coordinate system consists of three number lines, labeled X, Y and Z, set at 90 degree angles to each other as shown in Figure below. The origin, or Datum, is where the three axes cross each other. The labels, orientations, and directions of the Cartesian coordinate system in Figure are typical of most Vertical and Horizontal Machining Center (VMC & HMC).
Define CNC machine Jog mode	CNC machine Jog mode is one of the most used CNC mode. Jog mode is mostly used to travel the CNC machine carriage (or CNC machine Slide) such as CNC machine's axis movement e.g. x-axis z-axis. These axis movement can be via axis specific keys or through the

	CNC machine hand wheel.
Define Program repetition and looping	In actual machining, it is not always possible to machine to the final dimension in one go. This function enables the looping of a portion of the program so that the portion can be executed repeatedly.
Describe stages of a heat treatment process	Stage I — Heat the metal slowly to ensure a uniform temperature. Stage 2 — Soak (hold) the metal at a given temperature for a given time. Stage 3 — Cool the metal to room temperature.
Define Annealing process	Annealing is a process involving heating and cooling, usually applied to produce softening. The term also refers to treatments intended to alter mechanical or physical properties, produce a definite microstructure, or remove gases. The temperature of the operation and the rate of cooling depend upon the material being annealed and the purpose of the treatment.
Define Hardening Process	A ferrous metal is normally hardened by heating the metal to the required temperature and then cooling it rapidly by plunging the hot metal into a quenching medium, such as oil, water, or brine. Most steels must be cooled rapidly to harden them. The hardening process increases the hardness and strength of metal, but also increases its brittleness.
Define tempering?	Steel is usually harder than necessary and too brittle for practical use after being hardened. Severe internal

	stresses are set up during the rapid cooling of the metal. Steel is tempered after being hardened to relieve the internal stresses and reduce its brittleness. Tempering consists of heating the metal to a specified temperature and then permitting the metal to cool. The rate of cooling usually has no effect on the metal structure during tempering. Therefore, the metal is usually permitted to cool in still air. Temperatures used for tempering are normally much lower than the hardening temperatures. The higher the tempering temperature used, the softer the metal becomes. High-speed steel is one of the few metals that becomes harder instead of softer after it is tempered.
Define Quenching Crakes	Quenching cracks occurs when cooling rate is more than critical rate. It is avoided by tempering immediately and avoiding sharp corners.
Describe types of hardness testing methods	Hardness Rockwell C HRC Vickers Brinell
Define tensile strength	Tensile strength is the ability of a metal to resist being pulled apart by opposing forces acting in a straight line. It is expressed as the number of pounds of force required to pull apart a bar of the material 1 inch wide and 1 inch thick.

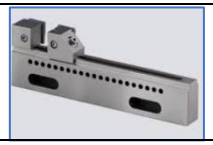
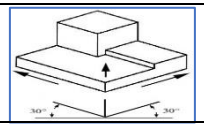
Test Yourself (Multiple Choice Questions)

MODULE	**2**			
Question	**1**	In an EDM the material removal is done though?	A	Fluid
			B	Pressure
			C	Heat
			D	Gas
Question	**2**	**What material cannot be machined on an EDM machine?**	A	Mild Steel
			B	Carbon Steel
			C	Copper

			D	Glass
Question	**3**	**To machine a material on EDM it must be ……?**	A	An Insulator
			B	A Conductor
			C	A Semi-Conductor
			D	Transparent

Question	**4**	What characteristics should an electrode material have?	A	High electrical conductivity
			B	High thermal conductivity
			C	Higher density
			D	All of above
Question	**5**	Accurate use of a dial indicator requires?	A	Oiling
			B	Rigid mounting
			C	Rough surface
			D	All of above
MODULE	**3**			
Question	**6**	The produces for each electric spark in wire cut is?	A	400 to 600 Degree Fahrenheit
			B	8000 to 16000 Degree Fahrenheit
			C	15000 to 21000 Degree Fahrenheit

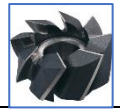
			D	40000 to 60000 Degree Fahrenheit
Question	**7**	Higher the pulse ON time results increased_____	A	Material removal
			B	finishing
			C	Machining time
			D	Cleaning time

Question	**8**	Gap Voltage is also called?	A	Off time
			B	Pulse time
			C	Finish time
			D	Open circuit voltage
Question	**9**	The Part shown in the figure is a ?	A	Wire gauge
			B	Wire cutter
			C	EDM fixture
			D	Wire Cut vise
MODULE	**4**			
Question	**10**	The view shown in the figure is an example of:	A	Orthographic Projection
			B	Isometric Projection
			C	Side view
			D	Plan view

Question	**11**	In CNC programing “G00” is used for?	A	Rapid movement
			B	Slow movement
			C	Feed rate
			D	Spindle speed

Question	**12**	For CNC programing what G code is used for tool length Compensation plus?	A	G02
			B	G03
			C	G43
			D	G17
Question	**13**	For CNC programing what G code is used for tapping mode?	A	G63
			B	G70
			C	G72
			D	G75
Question	**14**	What code gives an identifying number for each block of information	A	X
			B	Y
			C	Z
			D	N

MODULE	**5**			
Question	**15**	CNC machines are widely used in?	A	Garment industry
			B	Metal cutting industry
			C	Pipe producing industry
			D	Bottle filling industry

Question	**16**	The tool shown in the figure is a?	A	End mill cutter
			B	Shell end mill cutter
			C	Face mill cutter
			D	Dovetail cutter
Question	**17**	The tool shown in the figure is a?	A	End mill cutter
			B	Shell end mill cutter
				
			C	Face mill cutter
			D	Dovetail cutter
Question	**18**	The tool shown in the figure is a?	A	End mill cutter
			B	Shell end mill cutter
			C	Face mill cutter

			D	Dovetail cutter
Question	**19**	The tool shown in the figure is a?	A	End mill cutter
			B	Shell end mill cutter
			C	Face mill cutter
			D	Dovetail cutter
Module	**6**			
Question	**20**	A material property of resistance to indent or scratch is known as?	A	Toughness
			B	Hardness
			C	Ductility
			D	Malleability
Question	**21**	A material property of resistance to impact forces is known as?	A	Toughness
			B	Hardness

			C	Ductility
			D	Malleability
Question	**22**	The ability of material to deform under compression is known as?	A	Toughness
			B	Hardness
			C	Ductility
			D	Malleability
Question	**23**	The ability of material which doesn't allow material to with stand impact forces is known as?	A	Toughness
			B	Hardness
			C	Brittleness
			D	Malleability

Test Yourself (Multiple Choice Questions)

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Question	**7**	Higher the pulse ON time results increased_____	A	Material removal
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		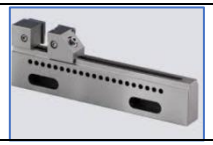	B	Wire cutter
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		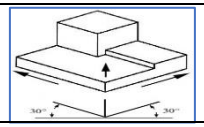	B	Isometric Projection
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		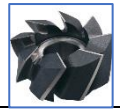	B	Shell end mill cutter
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Module	**6**			
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			B	Hardness
			C	Brittleness
			D	Malleability

Multiple Choice Questions Answers Scheme

MODULE	**2**			
Question	**1**	In an EDM the material removal is done though?	C	Heat
Question	**2**	What material cannot be machined on an EDM machine?	D	Glass
Question	**3**	To machine a material on EDM it must be ……?	B	A Conductor
Question	**4**	What characteristics should an electrode material have?	D	All of above
Question	**5**	Accurate use of a dial indicator requires?	B	Rigid mounting
MODULE	**3**			
Question	**6**	The produces for each electric spark in wire cut is?	C	15000 to 21000 Degree Fahrenheit
Question	**7**	Higher the pulse ON time results increased_____	A	Material removal
Question	**8**	Gap Voltage is also called?	D	Open circuit voltage
Question	**9**	The Part shown in the figure is a?	D	Wire Cut vise

MODULE	**4**			
Question	**10**	The view shown in the figure is an example of:	B	Isometric Projection
Question	**11**	In CNC programing “G00” is used for?	A	Rapid movement
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MODULE	**5**			
Question	**15**	CNC machines are widely used in?	B	Metal cutting industry
Question	**16**	The tool shown in the figure is a?	B	Shell end mill cutter
Question	**17**	The tool shown in the figure is a?	A	End mill cutter
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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