Curriculum

For

“Dies and Moulds Technology”

(CNC Machinist)

(Level -3)

National Vocational & Technical

Training Commission

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Introduction

Definition/ Description of the training programme for *Dies and Moulds Technology*

There is an increasing demand of the Dies and Moulds technologist. If an individual is planning to pursue a career in Dies and Moulds technology, this program will be helpful in targeting various industries including mechanical, electrical, automobile, hydraulics, computers, home appliances, ceramics, household products, plastic (especially furniture, Food packaging, crockery and aerospace sector) etc.

Purpose of the training programme

The purpose of this training is to develop a range of skills and techniques, personal skills and attributes essential for successful performance in Dies &Mould sector in accordance with industry requirements. Graduates of this program may find employment in local and international industries

Overall objectives of training programme

The main objective of this training program is to improve the employability of young graduates through qualifying job-related training in the Dies & Mould sector, and to train them so that they can prove to be an asset to this sector.

Competencies to be gained after completion of course

- Identify and implement Workplace Policies and Procedures
- Apply work health and safety practices (WHS)

- Communicate at workplace
- Perform CNC Lathe operations
- Perform Milling Operations
- Perform 2D & 3D Engineering Drawings using CAD
- Perform Welding Operations

Possible available job opportunities available immediately and later in the future

- Die & Mould Maker
- Die & Mould Designer
- CNC Programmer
- CAD/CAM Programmer
- Workshop Supervisor
- Charge Man
- Associate Engineer
- Sub Engineer
- Workshop Technician
- Production supervisor
- Dies & Mould Instructor
- Quality Supervisor
- Technical Designer

Trainee entry level

For National Vocational Certificate Level-3 in “CNC Machinist” (Dies and Moulds Technology), the entry requirement is award of National

Vocational Certificate Level-2 in “Machinist”.

Minimum qualification of trainer

- DAE in Dies and Mould/ Mechanical Technology or Equivalent with atleast 3 years experience*
- B.E/BSc/BS Technology in Mechanical/Mechatronics/Industrial and Manufacturing

*Other formal qualifications in the Dies & Mould would be useful in addition to the above

Recommended trainer: trainee ratio

The recommended maximum trainer: trainee ratio for this programme is 1 trainer for 25 trainees.

Medium of instruction i.e. language of instruction

Instruction will be Urdu and English.

Duration of the course (Total time, Theory & Practical time)

This curriculum comprises 07 modules. The recommended delivery time is 600 hours. Delivery of the course could therefore be full time, 5 days a week. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follow:

Module	Theory[1] Days/hours	Workplace[2] Days/hours	Total hours
Module 1: Identify and implement Workplace Policies and Procedures	10	10	20
Module 2: Apply work health and safety practices (WHS)	20	10	30
Module 3: Communicate at workplace	20	10	30
Module 4: Perform CNC Lathe operations	41	99	140
Module 5: Perform Milling Operations	41	99	140
Module6: Perform 2D & 3D Engineering Drawings using CAD	41	99	120
Module7: Perform Welding Operations	21	99	120

[1] Learning Module hours in training provider premises
[2] Training workshop, laboratory and on-the-job workplace

Sequence of the Modules

Each module covers a range of learning components. These are intended to provide detailed guidance to teachers (for example the Learning Elements component) and give them additional support for preparing their lessons (for example the Materials Required component). The detail provided by each module will contribute to a standardized approach to teaching, ensuring that training providers in different parts of the country have clear information on what should be taught. Each module also incorporates the industrial needs of Pakistan.

The distribution table is shown below:

<table>
<tr><td rowspan="2">Module 1: Identify and implement Workplace Policies and Procedures
20 Hours</td><td>Module 2: Apply work health and safety practices (WHS)
30 Hours</td><td rowspan="3">Module 3: Communicate at workplace
30 Hours</td></tr>
<tr><td>Module 5: Perform Milling Operations
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<tr><td>Module7: Perform Welding Operations
120 Hours</td><td>Module 4: Perform CNC Lathe operations
140 Hours</td></tr>
<tr><td colspan="3">Module 6: Perform 2D & 3DEngineering Drawings using CAD
120 Hours</td></tr>
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Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 1: Identify and Implement Workplace policies and Procedures **Aim:** After successful completion of this module, the trainee is competent in Identifying and Implement Workplace policies and Procedures	**LU1:** Identify workplace policy & procedures **LU2:** Implement workplace policy & procedures **LU3:** Communicate workplace policy & procedures **LU4:** Review the implementation of workplace policy & procedures	10	10	20
Module 2: Apply Work Health and Safety Practices (WHS **Aim:** After successful completion of this module, the trainee is competent in Applying Work Health and Safety Practices (WHS	**LU1:** Implement safe work practices at work place **LU2:** Participate in hazard assessment activities a work place **LU3:** Follow emergency procedures at workplace **LU4:** Participate in OHS consultative processes	20	10	30

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 3: Communicate at Workplace **Aim:** After successful completion of this module, the trainee is competent in Communicating at Workplace	**LU1:** Communicate within the organization **LU2:** Communicate outside the organization **LU3:** Communicate effectively in work group **LU4:** Communicate in writing	20	10	30
Module 4: Perform CNC Lathe Operations **Aim:** After successful completion of this module, the trainee is competent in performing CNC Lathe Operations	**LU1:** Generate the program **LU2:** Run Simulation **LU3:** Set the Job and Tool on CNC Lathe Machine **LU4:** Carry out CNC Lathe Operations	41	99	140

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 5: Perform Advance Milling Operations **Aim:** After successful completion of this module, the trainee is competent in performing advance milling operations	**LU1:** Prepare Milling machine for operation **LU2:** Perform workpiece setting for Milling operation **LU3:** Prepare a job/ Milling Operation as per drawing **LU4:** Inspect the job as per drawing	41	99	140
Module 6: Perform 2D &3D Engineering Drawings using CAD Software **Aim:** After successful completion of this module, the trainee is competent in performing 2D &3D Engineering Drawings using CAD Software	**LU1:** Draw 2D shapes **LU2:** Prepare final sets of 2D drawings **LU3:** Develop 3D Objects **LU4:** Manipulate 3D objects using 3D Editing Tools **LU5:** Render 3D Model	21	99	120

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module7: Perform Basic Welding Operations **Aim:** After successful completion of this module, the trainee is competent in performing Basic Welding Operations	**LU1:** Produce different types of Oxy Acetylene Flames **LU2:** Perform Oxy Acetylene Welding **LU3:** Perform oxy-acetylene Flame Cutting Operations **LU4:** Perform Shielded Metal Arc Welding (SMAW) **LU5:** Make Fillet Welds on Carbon Steel Plate by using. Gas Tungsten Arc Welding (GTAW) **LU6:** Make Fillet Welds on Carbon Steel Plate by using. Gas Metal Arc Welding (GMAW) **LU7:** Perform Soldering Operation **LU8:** Perform Brazing Operation	21	99	120

Modules

Module 1: Identify and Implement Workplace policies and Procedures

Objective of the module: The aim of this module to get knowledge, skills and understanding to Identify and Implement Workplace policies and Procedures

Duration: 20hours **Theory:** 10 hours **Practical:** 10 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Identify workplace policy & procedures	**The trainee will be able to:** **1.** Identify the workplace policy & procedures **2.** Apply appropriate strategies that can be used to measure whether your workplace health and safety obligations are being met **3.** Assure the policies are realistic, resources	• Define the workplace policy & procedures • Enlist the strategies for workplace health and safety obligations • Explain the workplace policies, resources and personnel • Describe the methods of implementation, outcomes and performance indicators	**Total:** 05hrs **Theory:** 02hrs **Practical:** 02hrs	• Notebooks • Pencils • Erasers • Sharpeners • White board • Multimedia • Internet • Computer system	Class room

	and personnel to implement **4.** Implement the policy & procedures that reflects the organizations commitments **5.** Ensure the appropriate methods of implementation, outcomes and performance indicators				
LU2: Implement workplace policy & procedures	**The trainee will be able to:** 1. Apply and assign responsibility for recording systems to track continuous improvements in	• Explain the procedures of Implementation of strategies for continuous improvement	**Total:** 05hrs **Theory:** 02hrs **Practical:** 02hrs	• Notebooks • Pencils • Erasers • Sharpeners • White board	Class room

	policy & procedures 2. Implement strategies for continuous improvement in effective and efficient information			• Multimedia • Internet • Computer system • PPEs (Safety glasses, Ear muffs/ear plugs, Protective Gloves, Cap, Safety shoes etc.)	
LU3: Communicate workplace policy & procedures	**The trainee will be able to:** 1. Communicate procedures to help implement workplace policy 2. Inform those involved in implementing the policy about	• Define the Communication procedures to help implement workplace policy	**Total:** 05hrs **Theory:** 03hrs **Practical:** 03hrs	• Notebooks • Pencils • Erasers • Sharpeners • White board • Multimedia • Internet	Class room

	expected outcomes, activities to be undertaken and assigned responsibilities			• Computer system • Safety manuals	
LU4: Review the implementation of workplace policy & procedures	**The trainee will be able to:** 1. Identify the trends that may require remedial actions 2. Record the trends that may require remedial actions 3. Ensure policy and procedures as required are made for continuous improvement of performance	• Describe the trends for required remedial actions	**Total:** 05hrs **Theory:** 03hrs **Practical:** 03hrs	• Notebooks • Pencils • Erasers • Sharpeners • White board • Multimedia • Internet • Computer system	Class room

Module 2: Apply Work Health and Safety Practices (WHS)

Objective of the module: The aim of this module to get knowledge, skills and understanding to Apply Work Health and Safety Practices (WHS)

Duration: 30 hours **Theory:** 20 hours **Practical:** 10hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Implement safe work practices at work place	**The trainee will be able to:** 1. Implement relevant rules and procedures of WHS at work place 2. Comply with duty of care requirements 3. Use personal protective equipment according to safe work practices 4. Contribute to WHS consultative	• Explain the WHS rights and responsibilities that apply to own role • Explain the term duty of care	**Total:** 07hrs **Theory:** 05hrs **Practical:** 02hrs	• Notebooks • Pen • White board • Multimedia • Internet • Computer system	Class room

	activities 5. Raise WHS issues with relevant personnel				
LU2: Participate in hazard assessment activities a work place	**The trainee will be able to:** 1. Identify hazards or WHS issues in the workplace to relevant personnel 2. Assess and control risks according to own level of responsibility, in line with workplace procedures 3. Report hazards or WHS issues in the workplace to relevant personnel 4. Document risk control actions as required	• List and describe common safety signs and symbols	**Total:** 08hrs **Theory:** 05hrs **Practical:** 03hrs	• Notebooks • Pen • White board • Multimedia • Internet • Computer system	Class room

LU3: Follow emergency procedures at workplace	**The trainee will be able to:** 1. Report emergencies or incidents promptly to relevant personnel 2. Deal with emergencies in line with own level of responsibility **3.** Implement evacuation procedures as required	• Describe typical health and safety roles in the workplace • Enlist emergencies or incidents relevant personnel • Define evacuation procedures at workplace	**Total:** 07hrs **Theory:** 05hrs **Practical:** 02hrs	• Notebooks Pen • White board • Multimedia • Internet • Computer system	Class room
LU4: Participate in OHS consultative processes	**The trainee will be able to:** 1. Contribute to workplace meetings, inspections or other consultative activities	• Importance of workplace meetings, inspections or other consultative activities • Enlist common OHS (Occupational Health and Safety) issues with accordance to the organizational procedures	**Total:** 08hrs **Theory:** 05hrs **Practical:** 03hrs	• Notebooks Pen • White board • Multimedia • Internet	Class room

	2. Raise OHS (Occupational Health and Safety) issues with designated persons in accordance with organizational procedures 3. Take actions to eliminate workplace hazards or to reduce risks	• Describe actions to eliminate workplace hazards or to reduce risks		• Computer system	

Module 3: Communicate at Workplace

Objective of the module: The aim of this module to get knowledge, skills and understanding to Communicate at Workplace.

Duration: 30 hours **Theory:** 10 hours **Practical:** 20 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Communicate within the organization	**The trainee will be able to:** **1.** Communicate within a department **2.** Communicate with other departments **3.** Use various media to communicate effectively **4.** Communicate orally and written	• Importance of intra and inter organizational communication • Types of Modes of communication • 8C's of communication	**Total:** 08hrs **Theory:** 03hrs **Practical:** 05hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • White board • Multimedia • Internet • Computer system	Class room
LU2: Communicate outside the organization	**The trainee will be able to:** 1. Deal with vendors 2. Deal with clients/customers 3. Interact with other	• Basics of business communication • Importance of communication	**Total:** 08hrs **Theory:** 03hrs	• Notebooks • Pencils • Erasers	Class room

	organisations 4. Use various media to communicate effectively 5. Work with people of different cultures / backgrounds	with clients/customers/vendor	**Practical:** 05hrs	• Sharpeners • White board • Multimedia • Internet • Computer system • Pen	

LU3: Communicate effectively in work group	**The trainee will be able to:**
	1. Assess the issues to provide relevant suggestion to group members
	2. Resolve the issues/ problems /conflicts within the group
	3. Arrange group working sessions to increase the level of participation in the group processes
	4. Communicate messages to group members clearly to ensure interpretation is valid
	5. Communicate style /manner
		• Explain the method of Communication in work group
		• Importance of communication style/manner
		• Method of feed back
		  ○ Verbal
		  ○ Written etc.
		• Types of feed back
		  ○ Informal
		  ○ Formal
		  ○ Formative
		  ○ Summative etc.
			Total: 07hrs
			Theory: 02hrs
			Practical: 05hrs
				• Notebooks
				• Pencils
				• Erasers
				• Sharpeners
				• White board
				• Multimedia
				• Internet
				Computer system
				Pen
					Class room

	to reflect professional standards/ awareness of appropriate cultural practices **6.** Act upon constructive feedback				
LU4: Communicate in writing	**The trainee will be able to:** 1. Identify relevant procedures for written information 2. Use strategies to ensure correct communication in writing .i.e. • correct composition • clarity • comprehensiveness • accuracy • appropriateness 3. Draft assigned written information for approval, ensuring it is written within designated timeframes 4. Ensure written information meets required standards of style, format and detail	• Define procedures for written information • Importance of communication strategies in writing	**Total:** 07hrs **Theory:** 02hrs **Practical:** 05hrs		

	5. Seek assistance / feedback to aid communication skills development				

Module 4: Perform CNC Lathe Operations

Objective of the module: The aim of this module is to get knowledge, skills and understanding to perform CNC Lathe operations

Duration: 140 hours **Theory:** 41hours **Practical:** 99hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place

LU1: Generate the program	**The trainee will be able to:** **1.** Interpret job requirements to remove extra material as per drawing/design **2.** Select absolute or incremental coordinates system (tool-path strategies, machining features and for generating the tool-path) as per requirement **3.** Generate appropriate part programming credentials (Sequence, G-codes, M-codes, coordinates, feed, speed, tooling information etc.) according to the CNC machine control unit	• Introduction to CNC lathe machine • Interpretation of drawing according to job • Explain G and M Codes functions • Explain absolute or incremental coordinates system (tool-path strategies, machining features and for generating the tool-path) • Explain Manual and software programing • Explain part programming credentials (Sequence, G-codes, M-codes, coordinates, feed, speed, tooling information etc.) • Describe program editing methods **Practical Activity:** • Prepare a part program according to drawing for a job to be machined on CNC Lathe	**Total:** 36hrs **Theory:** 25hrs **Practical:** 11hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Coolant • Cutting tools • Cleaning brush • Cotton rags • White board • Multimedia • Internet • Computer system • Measuring tools • Required Software • CNC Lathe machine	• Class Room • Workshop

				• PPEs'	
LU2: Run Simulation	**The trainee will be able to:** **1.** Feed the generated part	• Define Simulation	**Total:**	• Notebooks	• Class Room • Workshop

	program into appropriate simulation platform **2.** Run simulation and verify movements of tool/cutter to get same results as per defined sequence **3.** Correct the errors (if any) and modify the program as per defined procedure	• Describe the importance of performing Test run of the program • Describe Simulation methods • Explain transferring of generated Part program to required simulation platform • Explain the procedure to run simulation and verify movements of tool/cutter to get same results as per defined sequence • Explain the procedure to modify the program according to the requirement and re-checking of simulation **Practical Activity:** • Perform Test run of the program prepared in LU1	13hrs **Theory:** 05hrs **Practical:** 08hrs	• Pencils • Erasers • Sharpeners • Pen • Coolant • Cutting tools • Cleaning brush • Cotton rags • PPEs' • White board • Multimedia • Internet • Computer system • Measuring tools • Simulation Software • CNC Lathe machine	

LU3: Set the Job and Tool on CNC Lathe Machine	**The trainee will be able to:** **1.** Select appropriate tool & clamping device according to the job requirement **2.** Manage the measuring instruments as per job requirement **3.** Mount the work-piece as per job requirement according to the drawing/design **4.** Clamp the job firmly as per standards using appropriate work holding device(s) in order to achieve dimensional accuracy **5.** Check the alignment of job in chuck **6.** Mount the tools in tool post/tool turret as per job requirement **7.** Perform off-set setting (tool compensation) of the tools as per reference point of work	• Explain Pascal Law • Purpose of using pneumatic / hydraulic system and coolant • Knowledge of lathe machine tools according to operations (turning, facing, boring, threading and parting off, etc.) • Method of setting tools on turret • Explain tool off setting on machine • Standard procedure for workpiece zero setting • Setting of machining parameters (speed, feed depth of cut, etc.) **<u>Practical Activity:</u>** • Mount the job and tools and perform off-set setting according to part program	**Total:** 45hrs **Theory:** 05hrs **Practical:** 40hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Coolant • Cutting tools • Cleaning brush • Cotton rags • PPEs' • White board • Multimedia • Internet • Computer system • Measuring tools • CNC Lathe machine	• Class Room • Workshop

	piece				
LU4: Carry out CNC Lathe Operations	**The trainee will be able to:** **1.** Ensure to control the safe operation of working on CNC machines before executing part program according to the safety measures **2.** Control the feed and speed override of machine before and during the operation according to the requirement **3.** Switch machine to execution mode (single block or auto) and press cycle start to run the program **4.** Inspect the work piece accuracy and precision according to the drawing/design and take appropriate action in case of any error **5.** Check quality of the component at suitable	• Explain the method of machine execution (single, block or auto, etc.) • Standard procedures for CNC Lathe operations, including: o Controlling the feed and speed override of machine before and during the operation o Carrying out Turning operations o Switching machine to execution mode (single block or auto) and press cycle start to run the program o Taking standard safety measures during the whole process o Inspection of the workpiece • Explain how to neutralize and shut down the machine as per standard procedures **<u>Practical Activity:</u>** • Run the program to carry out	**Total:** 46hrs. **Theory:** 06hrs **Practical:** 40hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Coolant • Cutting tools • Cleaning brush • Cotton rags • PPEs' • White board • Multimedia • Internet • Computer system • Measuring tools • CNC Lathe	• Class Room • Workshop

	intervals **6.** Shut down the machine at safe position after finishing the work	machining operations and ensure accuracy of the job according to the drawing		machine	

Module 5: Perform Advance Milling Operations

Objective of the module: The aim of this module is to get knowledge, skills and understanding to perform advance milling operations

Duration: 140 hrs. **Theory:** 41hrs. **Practical:** 99 hrs.

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Prepare Milling machine for operation	**The trainee will be able to:** **1.** Select appropriate tool & clamping device according to the job requirement **2.** Manage the measuring instruments as per job requirement **3.** Mount the cutter as per standard procedure **4.** Set machine parameters according to the job requirement **5.** Arrange cutting fluid as per job requirement	• Explain Advance Milling Operations (Pocketing, Contouring, Drilling, Indexing Gear and Rack Cutting) • Milling Cutters (end milling cutters, ball end cutters, side and face milling cutter, gear cutters, carbide drills, etc. • Tool Holding devices (Arbor, tool holders, etc.) • Explain Milling strategies (Up-milling, Down-milling, rough cut,	**Total:** 39hrs **Theory:** 20hrs **Practical:** 19hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Coolant • Lubricants • Milling cutters • Cleaning brush • Cotton rags • PPEs'	• Class Room • Workshop

		finish cut, etc.) • Explain machine parameters, effects and settings (cutting speed, depth of cut and feed in cutting process, etc.) • Milling cutter and clamping devices (index head, rotary table, universal vice, swivel vice, machine vice, etc.) • Selection of Measuring instruments according to the requirement • Standard procedure to Mount the cutter • Standard procedures to set machine parameters **Practical Activity:** • Select the cutter and clamping devices according to the requirement of machining operation to be done on job		• White board • Multimedia • Internet • Computer system • Measuring tools • Milling machines with accessories and attachments	
LU2: Perform workpiece	**The trainee will be able to:** **1.** Verify the dimension of	• Explain the procedure to verify	**Total:**	• Notebooks	• Class Room • Workshop

setting for Milling operation	material according to the drawing **2.** Identify appropriate clamping device and check its alignment on machine table **3.** Clamp the workpiece as per requirement **4.** Dial the work piece & ensure final clamping	dimensions of materials • Standard procedures to set work-piece for Milling Operation **<u>Practical Activity:</u>** • Mount the job and cutter on machine using appropriate accessories according to the requirement of machining operation	25hrs **Theory:** 05hrs **Practical:** 20hrs	• Pencils • Erasers • Sharpeners • Pen • Coolant • Lubricants • Milling cutters • Cleaning brush • Cotton rags • PPEs' • White board • Multimedia • Internet • Computer system • Measuring tools • Milling machines with accessories and	

				attachments	
LU3: Perform Milling Operation as per drawing	**The trainee will be able to:** **1.** Perform pocketing as per given instructions **2.** Perform contouring as per given instructions **3.** Perform Drilling and Boring as per given instructions **4.** Perform Indexing as per given instructions **5.** Perform Gear Cutting as per given instructions	• Describe Pocketing • Standard procedures for Pocketing operations • Describe Contouring • Standard procedures for Contouring operations • Describe Drilling and Boring • Standard procedures for Drilling and Boring operations • Describe Indexing, types and related calculations • Standard procedures for Indexing operations • Describe Gears and terminologies • Explain types of Gears and related calculations • Standard procedures for Gear and Rack cutting **<u>Practical Activity:</u>** • Prepare a job on Milling Machine	**Total:** 58hrs **Theory:** 08hrs **Practical:** 50hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Coolant • Lubricants • Milling cutters • Cleaning brush • Cotton rags • PPEs' • White board • Multimedia • Internet • Computer system • Measuring tools	• Class Room • Workshop

		as per drawing		• Milling machines with accessories and attachments	
LU4: Inspect the job as per drawing	**The trainee will be able to:** **1.** Perform deburring of the job using appropriate tool **2.** Inspect the job using appropriate measuring tool **3.** Perform cleaning/deburring of the job using appropriate tool **4.** Inspect the job using appropriate measuring tool **5.** Check quality of the component at suitable intervals **6.** Shut down the machine at safe position after finishing the work	• Describe Post milling operations (deburring, chamfering, cleaning etc.) • Standard procedures to check quality of the workpiece as per requirement • Explain how to neutralize and shut down the machine as per standard procedures **<u>Practical Activity:</u>** • Perform inspection of the job according to the drawings	**Total:** 18hrs **Theory:** 08hrs **Practical:** 10hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Coolant • Lubricants • Milling cutters • Cleaning brush • Cotton rags • PPEs' • White board • Multimedia • Internet	• Class Room • Workshop

				• Computer system • Measuring tools • Milling machines with accessories and attachments	

Module 6: Perform 2D & 3D Engineering Drawings using CAD Software

Objective of the module: The aim of this module is to get knowledge, skills and understanding to perform 2D &3D Engineering Drawings using CAD Software

Duration: 120 hours **Theory:** 21 hours **Practical:** 99hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Draw 2D shapes	**The trainee will be able to:** **1.** Setup user interface settings for required drawing **2.** Create different 2D shapes with given measurements **3.** Edit different 2D shapes to meet requirement **4.** Insert dimensions and symbols as	• Explain the work space and setup the interface settings • Describe Sketch environment and application of sketching tools • Interpret drawing of different shapes • Explain editing tools for modify shapes • Describe dimensions and relevant symbols • Explain different formats for saving drawing **<u>Practical Activity:</u>**	**Total:** 24hrs **Theory:** 04hrs **Practical:** 20hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Drawing sheets • White board • Multimedia • Internet • Computer	• Class room/ Lab

	per requirement **5.** Save the file in different drawing formats	• Draw different geometrical 2D shapes and curves and insert the dimensions and symbols on CAD Software		system • Printer	
LU2: Prepare final sets of 2D drawings	**The trainee will be able to:** **1.** Develop 2D Drawing with given project specification and measurements **2.** Plot drawing on scale according to required size & orientation.	• Describe multi views of 2D Drawing • Explain dimensioning, annotations and title block • Explain print/plot setting according to scale **<u>Practical Activity:</u>** • Prepare a 2D drawing of Multiple views with dimensions, annotations	**Total:** 25hrs **Theory:** 05hrs **Practical:** 20hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Drawing sheets • White board	• Class room/ Lab

		and title block of given assignment		• Multimedia • Internet • Computer system • Printer	
LU3: Develop 3D Objects	**The trainee will be able to:** **1.** Setup 3D user interface settings for required drawing **2.** Create different 3D objects with given measurements	• Describe different types of 3D modelling • Describe 3D interface and tools applications for creating 3D model of job • Describe primitives and explain 3D objects **<u>Practical Activity:</u>** • Prepare 3D Model of given assignments	**Total:** 30hrs **Theory:** 05hrs **Practical:** 25hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Drawing sheets • White board • Multimedia • Internet • Computer system • Printer	• Class room/ Lab

LU4: Manipulate 3D objects using 3D Editing Tools	**The trainee will be able to:** **1.** Modify 3D objects in line with the requirements **2.** Make customized 3D models according to the requirement of given job **3.** Generate orthographic views from 3D model **4.** Generate sectional/auxiliary views from 3D model as per requirement	• Explain editing tools for modification of 3D model • Explain Drafting module/environment in design software • Describe projection and section tools and its application • Explain Projection views as per requirement of job **<u>Practical Activity:</u>** • Manipulate a 3D Model using different editing tools as per instructions • Draw different orthographic and section views from given 3D Model	**Total:** 24hrs **Theory:** 04hrs **Practical:** 20hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Drawing sheets • White board • Multimedia • Internet • Computer system • Printer	• Class room/ Lab
LU5: Render 3D Model	**The trainee will be able to:** **1.** Apply material to	• Describe procedure for applying material on designed job in	**Total:** 17hrs	• Notebooks • Pencils	• Class room/ Lab

	required 3D Model as per given specification **2.** Apply texture to 3D model as per requirement **3.** Render and print the 3D model according to required size & orientation	software • Describe Rendering environment and light settings etc. • Describe procedure for applying texture in software • Describe print setting and output formats for 3D rendering **<u>Practical Activity:</u>** • Apply texturing and rendering techniques on 3D model as per requirement	**Theory:** 03hrs **Practical:** 14hrs	• Erasers • Sharpeners • Pen • Drawing sheets • White board • Multimedia • Internet • Computer system • Printer	

Module 7: Perform Basic Welding Operations

Objective of the module: The aim of this module is to get knowledge, skills and understanding to perform basic welding operations

Duration: 120 hours **Theory:** 21 hours **Practical:** 99 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Produce different types of Oxy Acetylene Flames	**The trainee will be able to:** 1. Check pressure from gauges on Oxygen and Acetylene cylinder 2. Check gas manifold system 3. Open Acetylene gas valve slightly and light the torch with spark lighter 4. Open oxygen gas valve slightly to balance the both gases as per requirement of flame: o Produce oxidizing	• Define welding. • Describe different types of welding processes • Define gas welding • Types of gas welding • Describe types of fuels commonly used in gas welding • Describe how to identify the oxygen and acetylene cylinders • Describe the different types of Oxy Acetylene flame • Describe the pressure of gases	**Total:** 13hrs **Theory:** 03hrs **Practical:** 10hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Oxygen gas cylinder • Acetylene gas cylinder • flux • White board • Multimedia	• Class Room • Workshop

	flame ○ Produce neutral flame ○ Produce carburizing flame	for oxidizing, neutral and carburizing flames • Describe how to produce different types of flames **Practical Activity:** • Produce three types of oxy acetylene flame and describe their applications		• Internet • Computer system • Oxy Acetylene welding table • Oxy Acetylene welding torch • Chipping hammer • Wire brush • Gas cylinder key • PPEs'	
LU2: Perform Oxy Acetylene Welding	**The trainee will be able to:** **1.** Take work pieces as per drawing **2.** Grind the work pieces on grinding machine to prepare the edges flat and parallel to each other **3.** Place the Bottom piece on work table and place the top plate	• Define Oxy Acetylene welding. • Describe different grades and sizes of filler rods. • Describe types of flux used in gas welding • Explain the working of Oxy Acetylene welding torch. • Explain different types of welding joints. • Describe different types of	**Total:** 13hrs **Theory:** 03hrs **Practical:** 10hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Oxygen gas • Acetylene gas • flux	• Class Room • Workshop

	along the marked line **4.** Set the flame of welding torch as per standard **5.** Complete the bead as per standard	welding positions. • Describe how to perform Oxy Acetylene welding **Practical Activity:** • Prepare different types of weld joints using oxy acetylene gas welding		• White board • Multimedia • Internet • Computer system • Oxy Acetylene welding table • Oxy Acetylene welding torch • Chipping hammer • Wire brush • Gas cylinder key • PPEs'	
LU3: Perform oxy-acetylene Flame Cutting Operations	**The trainee will be able to:** **1.** Take work pieces as per drawing **2.** Perform layout marking on workpiece for cutting as per requirement **3.** Set the flame of	• Describe flame cutting • Describe the difference between welding flame and cutting flame • Describe applications of Oxy Acetylene flame cutting operation • Describe how to perform Oxy	**Total:** 11hrs **Theory:** 01hrs **Practical:**	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Oxygen gas • Acetylene gas	• Class Room • Workshop

	welding torch in oxidizing flame as per standard **4.** Start cutting of work piece while maintaining standard distance betwee welding torch nozzle and work piece **5.** Complete the cut as per requirement	Acetylene flame cutting operation **Practical Activity:** • Perform oxy-acetylene Cutting Operations on job according to requirement	10hrs	• flux • White board • Multimedia • Internet • Computer system • Oxy Acetylene welding table • Oxy Acetylene welding torch • Chipping hammer • Wire brush • Gas cylinder key • PPEs'	
LU4: Perform Shielded Metal Arc Welding (SMAW)	**The trainee will be able to:** **1.** Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job	• Define arc welding • Define shielded metal arc welding • Types of electrodes used in SMAW	**Total:** 19hrs **Theory:** 04hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen	• Class Room • Workshop

	requirement to produce acceptable weld **2.** Maintain gap between electrode and base metal as per standard practices **3.** Carry out welding as per given metal properties **4.** Deposit root pass as per welding procedure specifications/job requirements **5.** Deposit filling passes as per welding procedure specifications/job requirements **6.** Deposit capping pass as per welding procedure specifications/job requirements **7.** Check root, filling and capping passes for any visual discontinuities as	• Describe how to adjust the welding parameters for different types of electrodes and workpiece • Describe root pass, filling pass and capping pass • Describe how to deposit root pass, filling pass and capping pass. • Describe common welding defects • Describe different applications of SMAW **<u>Practical Activity:</u>** • Prepare different groove welds using shielded metal arc welding (SMAW)	**Practical:** 15hrs	• Welding rods • White board • Multimedia • Internet • Computer system • Electric arc welding table • Electric arc welding pliers • Electric arc welding transformer • Chipping hammer • Wire brush • PPEs'	

	per acceptance standards **8.** Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects				
LU5: Make Fillet Welds on Carbon Steel Plate by using. Gas Tungsten Arc Welding (GTAW)	**The trainee will be able to:** **1.** Adjust welding parameters (current, voltage etc.) as per welding procedure specifications/job requirements to produce acceptable weld **2.** Maintain gap between electrode and base metal as per standard practices **3.** Carry out welding in Vertical (3F) and Vertical (3G) positions following	• Describe gas tungsten arc welding • Describe the specifications of non-consumable tungsten rod used in GTAW • Types and function of inert shielded gases used in GTAW • Describe how to adjust the welding parameters for different types of electrodes and workpiece • Describe different applications of GTAW **<u>Practical Activity:</u>**	**Total:** 18hrs **Theory:** 03hrs **Practical:** 15hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Quenching media • Inert gas cylinders • Filler metal wires • White board • Multimedia	• Class Room • Workshop

	standard procedures **4.** Deposit root pass as per welding procedure specifications/job requirements **5.** Deposit filling passes as per welding procedure specifications/job requirements **6.** Deposit capping pass as per welding procedure specifications/job requirements **7.** Check root, filling and capping passes for any visual discontinuities as per acceptance standards **8.** Follow applicable manufacturing codes and standards for acceptance criteria of visual welding defects	• Prepare fillet joints using Gas Tungsten Arc Welding (GTAW) Techniques		• Internet • Computer system • Electric arc welding table • Electric arc welding pliers • Electric arc welding transformer • Tungsten electrode • Chipping hammer • Wire brush • Gas cylinder key • PPEs'	

LU6: Make Fillet Welds on Carbon Steel Plate by using. Gas Metal Arc Welding (GMAW)	**The trainee will be able to:** **1.** Adjust welding parameters (current, voltage, wire feed speed etc.) as per welding procedure specifications/job requirements to produce acceptable weld **2.** Maintain gap between electrode and base metal as per standard practices **3.** Carry out welding in Vertical (3F) and Overhead (4F) positions following standard procedures **4.** Follow applicable manufacturing codes and standards for acceptance criteria of	• Describe gas metal arc welding • Describe the difference between SMAW and GMAW • Describe the difference between GTAW and GMAW • Types and function of inert shielded gases used in GMAW • Describe different applications of GMAW **Practical Activity:** • Prepare fillet joints using Gas Metal Arc Welding (GMAW) Techniques	**Total:** 18hrs **Theory:** 03hrs **Practical:** 15hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Inert gas cylinders • Welding rods • White board • Multimedia • Internet • Computer system • Electric arc welding table • Electric arc welding pliers • Electric arc welding transformer • Chipping	• Class Room • Workshop

	visual welding defects			hammer • Wire brush • Gas cylinder key • PPEs'	
LU7: Perform Soldering Operation	**The trainee will be able to:** **1.** Perform marking as per drawing **2.** Cut the metal sheet according to drawing using shearing machine **3.** Straighten the material with help of hammer **4.** File work if required **5.** Perform soldering operation as per standard	• Define soldering operation • Describe different types of solders • Describe different applications of soldering **Practical Activity:** • Perform soldering operation on given job	**Total:** 11hrs **Theory:** 02hrs **Practical:** 09hrs	• Notebooks • Pencils • Erasers • Sharpeners • Pen • Solder wire • White board • Multimedia • Internet • Computer system • Solder gun • PPEs'	• Class Room • Workshop
LU8: Perform Brazing Operation	**The trainee will be able to:** **1.** Perform marking as per drawing	• Define brazing process • Types of filler metals used for	**Total:**	• Notebooks • Pencils	• Class Room • Workshop

	2. Cut the metal sheet according to drawing using shearing machine **3.** Straighten the material with help of hammer **4.** File work if required **5.** Open gas cylinder with the help of cylinder key **6.** Adjust pressure of both gas cylinders with the help of regulator **7.** Select the correct size of the nozzle **8.** Set flame to carburizing flame as per standard **9.** Use copper filler rod as filler metal **10.** Perform brazing as per standard	brazing • Describe different applications of brazing **<u>Practical Activity:</u>** • Perform gas brazing operation on given job	10hrs **Theory:** 01hrs **Practical:** 09hrs	• Erasers • Sharpeners • Pen • Filler rod • White board • Multimedia • Internet • Computer system • Electrode holders • PPEs'	
LU 9: Perform Post Welding Operations	**The trainee will be able to:** **1.** Carry out finishing work of welds following standard procedures	• Describe visual welding defects • Describe welding codes and	**Total:** 07hrs **Theory:**	• Notebooks • Pencils • Erasers	•

	2. Inspect weld visually and mark any visual defects, as required **3.** Carry out repair work in accordance with approved procedures, as required **4.** Clean work area in accordance with workplace safety practices **5.** Maintain and store tools/equipment/consumable materials in accordance with organization guidelines	standards • Describe different types of post welding operations **Practical Activity:** • Perform inspection of welded joints and rectify the defects (if required)	01hrs **Practical:** 06hrs	• Sharpeners • Pen • White board • Multimedia • Internet • Computer system • Chipping hammer • Wire brush • PPEs'	

General assessment guidance for *Dies & Mould Technology*

Good practice in Pakistan makes use of sessional and final assessments, the basis of which is described below. Good practice by vocational training providers in Pakistan is to use a combination of these sessional and final assessments, combined to produce the final qualification result.

Sessional assessment is going on all the time. Its purpose is to provide feedback on what students are learning:

- To the student: to identify achievement and areas for further work
- To the teacher: to evaluate the effectiveness of teaching to date, and to focus future plans.

Assessors need to devise sessional assessments for both theoretical and practical work. Guidance is provided in the assessment strategy

Final assessment is the assessment, usually on completion of a course or module, which says whether or not the student has "passed". It is – or should be – undertaken with reference to all the objectives or outcomes of the course, and is usually fairly formal. Considerations of security – ensuring that the student who gets the credit is the person who did the work – assume considerable importance in final assessment.

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted.

For workplace lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process.

Methods include direct assessment, which is the most desirable form of assessment. For this method, evidence is obtained by direct observation of the student's performance.

Examples for direct assessment of a Dies & Mould Technology include:

- Work performances, for example perform basic communication, maintain personal health, hygiene and safety and perform basic computer operations
- Demonstrations, for example Milling and Welding
- Direct questioning, where the assessor would ask the student how to perform personal safety at work place, how they can communicate work place policy and procedures, how they can handle documents, what are the benefits of Milling and Welding
- Paper-based tests, such as multiple choice or short answer questions on communication at work place policy and procedures, Milling and Welding
- Indirect assessment is the method used where the performance could not be watched and evidence is gained indirectly.

Examples for indirect assessment of a Dies & Mould Technology include:

- Work products, such as Milling, perform some procedures of Welding

Indirect assessment should only be a second choice. (In some cases, it may not even be guaranteed that the work products were produced by the person being assessed.)

Principles of assessment

All assessments should be valid, reliable, fair and flexible:

Fairness means that there should be no advantages or disadvantages for any assessed person. For example, it should not happen that one student gets prior information about the type of work performance that will be assessed, while another candidate does not get any prior information.

Validity means that a valid assessment assesses what it claims to assess. For example, if Milling and Welding are to be assessed and certificated, the assessment should involve performance criteria that are directly related to that activity. An interview about the Milling would not meet the performance criteria.

Reliability means that the assessment is consistent and reproducible. For example, if the work performance of preparing documents in words has been assessed, another assessor (e.g. the future employer) should be able to see the same work performance and witness the same level of achievement.

Flexibility means that the assessor has to be flexible concerning the assessment approach. For example, if there is a power failure during the assessment, the assessor should modify the arrangements to accommodate the students' needs.

Assessment strategy for Dies & Mould Technology

This curriculum consists of 07modules:

- **Module 1:** Identify and implement Workplace Policies and Procedures
- **Module 2:** Apply work health and safety practices (WHS)
- **Module 3:** Communicate at workplace
- **Module 4:** Perform CNC Lathe operations
- **Module 5:** Perform Advance Milling Operations
- **Module 6:** Perform 2D & 3D Engineering Drawings using CAD Software
- **Module 7:** Perform Welding Operations

Sessional assessment

The sessional assessment for all modules shall be in two parts: theoretical assessment and practical assessment. The sessional marks shall contribute to the final qualification.

Theoretical assessment for all learning modules must consist of a written paper lasting at least one hour per module. This can be a combination of multiple choice and short answer questions.

For practical assessment, all procedures and methods for the modules must be assessed on a sessional basis. Guidance is provided below under Planning for assessment.

Final assessment

Final assessment shall be in two parts: theoretical assessment and practical assessment. The final assessment marks shall contribute to the final qualification.

The assessment team

The number of assessors must meet the needs of the students and the training provider. For example, where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 25 students shall therefore require assessments to be carried out over a four-day period. For a group of only 10 to 15 students, assessments would be carried out over a two-day period only.

Planning for assessment

Sessional assessment: assessors need to plan in advance how they will conduct sessional assessments for each module. The tables on the following pages are for assessors to use to insert how many hours of theoretical and practical assessment will be conducted and what the scheduled dates are.

Final assessment: Training providers need to decide ways to combine modules into a cohesive two-day final assessment programme for each group of five students. Training providers must agree the content for practical assessments in advance.

Complete list of tools and equipment

Sr#	Description	Quantity
1.	Computer with internet	26
2.	White board	1
3.	Multimedia	1
4.	Scanner	1
5.	Hardness Testers	1

6.	Universal testing machine(UTM)	1
7.	Impact Testing Machines	1
8.	Lathe machine with accessories	5
9.	Lathe Tools(Facing, Threading, Knurling, Parting off, Forming etc)	10each
10.	Drilling machine with accessories	5
11.	Drilling tools (twist drill, center drill, counter boring tool , reamer, taps etc)	10 each
12.	Milling Machine with accessories	5
13.	Milling tools(End mill, Ball nose, Face mill, Side and face mill, Slab mill, Convex cutter, Concave cutter, Dovetail cutter, Involute cutter ,etc)	10 each
14.	Surface Grinding Machine with accessories and consumables	2
15.	Cylindrical Grinding Machine with accessories and consumables	2
16.	Pedestal Grinder with accessories and consumables	2
17.	Tool and cutter Grinder with accessories and consumables	2
18.	Shaper Machine with accessories	2
19.	Planar Machine with accessories	1
20.	Steel Rules	10
21.	Tri Square	10
22.	Inside Vernier Caliper	10
23.	Odd leg Vernier Caliper	10
24.	Trammel Vernier Caliper	10
25.	Outside Vernier Caliper	10

26.	Vernier Depth gauge	5
27.	Vernier Bevel protractor	5
28.	Thread gauges	5
29.	Screw pitch gauges	5
30.	Fillet gauges	5
31.	Feeler gauges	5
32.	Vernier Height gauge	5
33.	Dial indicators with magnetic stand	5
34.	Vernier Micrometer	5
35.	Inside Micrometer	5
36.	Outside Micrometer	10
37.	Depth Micrometer	5
38.	Snap Gauge set	2
39.	Dial Bore Gauge	5
40.	Set of Adjustable Wrench	5
41.	Set of Spanners (Open end, Ring)	5 each
42.	Pipe wrench	2
43.	Pipe Dies	2
44.	L-key sets	5
45.	Nose pliers	5
46.	Grip pliers	5

47.	Straight peen Hammer	5
48.	Ball peen Hammer	5
49.	Mallets Hammer	5
50.	Claw Hammer	5
51.	Long nose Tong	5
52.	Short nose tong	5
53.	Flat Chisel	5
54.	Scrapper of different shapes	5 each
55.	Scriber	10
56.	Hand hacksaw	25
57.	Chipping hammer	10
58.	Oxy acetylene welding torch	10
59.	Tip cleaners	5
60.	Oxy acetylene welding cylinder set(oxygen, C2H2)	5
61.	Oxy acetylene welding table	5
62.	Welding gloves	10 set
63.	Face screen	10
64.	Goggles	10
65.	Electric arc welding transformer	5
66.	Electric arc welding pliers	5
67.	Disc grinder 4 inch	5

68.	Disc cutter	5
69.	Electric arc welding table	5
70.	Welding electrode of different size & grade	10 packs
71.	3D scanner	1
72.	3D printer	1
73.	Rockwell Hardness tester	1
74.	Brinell Hardness tester	1
75.	Vicker Hardness tester	1
76.	Mould polishing stones(Mesh no 240 to 1200)	10 each
77.	Sand papers of different grade(Mesh no 180 to 2000)	10 each
78.	Diamond Paste tubes of different grades (Micron 2500 to 5000)	2 each
79.	Ceramics stones of different grades (Mesh no 300 to 1200)	5 each
80.	Diamond hand file set	5 set
81.	Riffle hand file set	5
82.	Needle hand file set	5
83.	Round hand file	5
84.	Half round hand file	5
85.	Triangular hand file	5
86.	Square hand file	5
87.	Flat hand file	5
88.	Ultra sonic Polishing box	2

89.	Drawing board	25

List of consumable supplies

Sr no	Material	Quantity
1.	Note book	25
2.	Pencil	25
3.	White sheets	25
4.	Eraser	25
5.	Sharpener	25
6.	Pen	25
7.	Clutch pencils	25

Credit values

The credit value of the National Certificate Level 3 in Dies & Mould Technology is defined by estimating the amount of time/ instruction hours required to complete each competency unit and competency standard. The NVQF uses a standard credit value of 1 credit = 10 hours of learning (Following Higher Education Commission (HEC) guidelines.

The credit values are as follows:

Competency Standard	Estimate of hours	Credit
A. Identify and implement Workplace Policies and Procedures	20	02
B. Apply work health and safety practices (WHS)	30	03
C. Communicate at workplace	30	03
D. Perform CNC Lathe operations	140	14
E. Perform Milling Operations	140	14
F. Perform 2D & 3DEngineering Drawings using CAD	120	12
G. Perform Basic Welding Operations	120	12

Curriculum Validation Committee

Name	Designation
1. Mr. Nadeem Shahid	Vice Principal, PITAC Lahore
2. Mr. Naveed Aslam Qureshi	Deputy Director, PITAC Lahore
3. Mr. Muhammad Tariq Pervaiz	Retd PITAC, Lahore
4. Ms Tehrim Ijaz	BS industrial Engineer, Lahore
5. Ms. Ariba Afzal Kazi	BS Metallurgy, Material Engineer, Lahore
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7. Engr. Rashid Bashir	Instructor, PSTC, Lahore
8. Engr. Salman Khalid	AD, PITAC, Lahore

Name	Designation
9. Engr.Tashiq Semab Amin	Dy Manager, HIT, Taxila
10. Engr. Abdul Waqar	CAD CAM designer, Shan Group Engineering Wing, Peshawar
11. Engr. Liaqat Ali Jamhroo	Director Academics, STEVTA
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13. Syed Mansoor Ahmad	Assistant Manager, NVQF Registrary Incharge, SBTE, Karachi
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