Co-funded by the European Union

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Norwegian Embassy
Islamabad

PLASTIC PROCESSOR

TRAINER GUIDE

National Vocational Certificate Level 4

Version 1 - September, 2018

NAVTTC

Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Published by
National Vocational and Technical Training Commission
Government of Pakistan

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

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

Layout & design
SAP Communications

Photo Credits
TVET Sector Support Programme

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

Document Version
September, 2018
Islamabad, Pakistan

PLASTIC PROCESSOR

TRAINER GUIDE

National Vocational Certificate Level 4

Version 1 - September, 2018

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 Plastic Processor 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 Plastic Processor 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 internalized 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.

FORMAT FOR LESSON PLAN			
Module 6: Produce Injection Moulded Plastic Parts			
Learning Unit 1: Interpret Work Order			
Methods	Key Notes	Media	Time
	Lead a discussion on Interpreting Workorders. Encourage ALL trainees to participate in the discussion. Ensure that the discussion addresses the following points: • Obtain work order • Verify production quantity available • Ensure raw material available as per work order • Ensure machine setting for production as per data sheet provided		
	Introduction		
	This session will introduce learners to the necessary set of information required to run scheduled production. The process and steps necessary for the acquisition of such information and the relevant paperwork.		
	Main Body		
	• How to obtain workorder • Different sets of information contained in a workorder • Arrangement of raw material as per workorder • Setting up of machine as per workorder		
	Conclusion		
	To conclude the session, review the tools, techniques and material used for producing injection moulded plastic parts. Give learners the opportunity to ask questions.		
	<u>Assessment</u> Question and answer, discussion groups with feedback, observation of practice skills development		
			Total time:

Overview of the program

Course: Plastic Processor Level 4	**Total Course Duration:** 6 months
Course Overview:	
Plastic Processor curriculum will prepare students to efficiently operate plastic processing machines such as injection moulding, compression, and extrusion, and to perform basic preventive maintenance on most types of plastic processing machines and equipment. Coursework includes Safety, Plastic moulding Machines operations, grades, Legal & environmental concerns & equipment maintenance. Graduates of this program may find employment with state and local government agencies and private contractors engaged in manufacturing or other plastic processing activities.	

Module Title and Aim	**Learning Units**	**Timeframe of modules**
Module 1: Contribute to Work Related Health and Safety (WHS) Initiatives **Aim:** This unit describes the skills and knowledge required to manage the identification, review, development, implementation and evaluation of effective participation and consultation processes as an integral part of managing work health and safety (WHS).	**LU1.** Contribute to initiate work-related health and safety measures **LU2.** Contribute to establish work-related health and safety measures **LU3.** Contribute to ensure legal requirements of WHS measures **LU4.** Contribute to review WHS measures **LU5.** Evaluate the organization's WHS system	30

Module Title and Aim	Learning Units	Timeframe of modules
Module 2: Comply with Workplace Policy and Procedures **Aim:** This unit describes the skills and knowledge required to implement a workplace policy & procedures and to modify the policy to suit changed circumstances. It applies to individuals with managerial responsibilities who undertake work developing approaches to create, monitor and improve strategies and policies within workplaces and engage with a range of relevant stakeholders and specialists.	**LU1.** Manage work timeframes **LU2.** Manage to convene meeting **LU3.** Decision making at workplace **LU4.** Set and meet own work priorities at instent **LU5.** Develop and maintain professional competence **LU6.** Follow and implement work safety requirements	30
Module 3: Perform Advanced Communication **Aim:** This unit describes the performance outcomes, skills and knowledge required to develop communication skills used professionally. It covers plan and organise work and conduct trainings at workplace, along with demonstrating professional skills independently	**LU1.** Demonstrate professional skills **LU2.** Plan and Organize work **LU3.** Provide trainings at workplace	30

Module Title and Aim	Learning Units	Timeframe of modules
Module 4: Develop Advance Computer Application Skills **Aim:** This unit provides an overview of Microsoft Office programs to create personal, academic and business documents following current professional and/or industry standards, i.e. Data Entry, Power Point Presentation and managing data base and graphics for Design It applies to individuals employed in a range of work environments who need to be able to present a set range of data in a simple and direct forms	**LU1.** Manage Information System to complete a task **LU2.** Prepare Presentation using computers **LU3.** Use Microsoft Access to manage database **LU4.** Develop graphics for Design	40
Module 5: Manage Human Resource Services **Aim:** This unit describes the skills and knowledge required to plan, manage and evaluate delivery of human resource services, integrating business ethics. It applies to individuals with responsibility for coordinating a range of human resource services across an organization. They may have staff reporting to them.	**LU1.** Determine strategies for delivery of human resource services **LU2.** Manage the delivery of human resource services **LU3.** Evaluate human resource service delivery **LU4.** Manage integration of business ethics in human resource practices	20

Module Title and Aim	Learning Units	Timeframe of modules
Module 6: Develop Entrepreneurial Skills **Aim:** This Competency Standard identifies the competencies required to develop entrepreneurial skills, in accordance with the organization's approved guidelines and procedures. You will be expected to develop a business plan, collect information regarding funding sources, develop a marketing plan and develop basic business communication skills. Your underpinning knowledge regarding entrepreneurial skills will be sufficient to provide you the basis for your work.	**LU1.** Develop a business plan **LU2.** Collect information regarding funding sources **LU3.** Develop a marketing plan **LU4.** Develop basic business communication skills	30
Module 7: Perform Off Tool Sampling **Aim:** This competency standard identifies the competencies required to perform off tool sampling in accordance with job order/sheet's guidelines. You will be expected to carry out off tool sample, ensuring cost effectiveness, conforming to standards and regulations. The underpinning knowledge regarding off tool sampling will be enough to provide the basis for your work.	**LU1:** Ensure type of Tool **LU2:** Set Machine Parameters **LU3:** Execute Dry Run Operation **LU4:** Produce Sample **LU5:** Verify Sample Specification **LU6:** Generate Sample Report **LU7:** Take Approval for Processing	150

Module Title and Aim	Learning Units	Timeframe of modules
Module 8: Perform Tool Change over **Aim:** The standard covers specific knowledge related to operation of tool change procedure, installation and explaining parameter setting, and reporting procedure of machine.	**LU1:** Obtain Work Order according to Standard **LU2:** Prepare took for Production **LU3:** Carry out Tool Installation **LU4:** Carry out Tool Storage	150
Module 9: Perform Shutdown Procedure **Aim:** This competency standard is designed to provide skills and knowledge to performance shutdown procedures to machine in accordance with the manufacturer's Manual. You will be able to perform arrangement of tools, shutdown as planned, and emergency shutdown as per machine requirement. The standard covers specific knowledge related to operation of shutdown procedure, and reporting procedure of machine.	**LU1:** Arrange Tools and Accessories **LU2:** Perform Planned Shutdown **LU3:** Perform Emergency Shutdown	100

Module Title and Aim	Learning Units	Timeframe of modules
Module 10: Manage Product Quality **Aim:** This competency standard is designed to provide skills and knowledge to manage product quality, in accordance with inspection procedure, irregularities, quality acceptance, of quality control department. You will be able to report quality inspection and facilitate quality audit process. The underpinning knowledge regarding quality management and procedure of quality audit of sample and production will be enough to provide the basis for your work.	**LU1:** Perform Inspection **LU2:** Identify Irregularities As Per Standard **LU3:** Apply Acceptable Quality Level to Product **LU4:** Prepare Quality Inspection Report **LU5:** Facilitate in Auditing	120
Module 11: Manage Production Flow **Aim:** This competency standard is designed to provide skills and knowledge to manage production flow of machine in accordance with the manufacturer's Manual. You will be able to perform planning of production schedule, ensuring of raw material and accessories, verify data sheet of machine and prepare production report. The standard covers specific knowledge related to management of production workflow, identifying bottlenecks and rectifying them.	**LU1:** Plan Production Schedule **LU2:** Ensure Raw Material & Accessories **LU3:** Ensure the Machine Data Sheet **LU4:** Prepare Production Report	100

Module 7: 072200919 Perform Off Tool Sampling			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Ensure type of tool	Deliver an illustrated presentation on how to ensure type of tool. Ensure you address the importance of the following points: i) Machine knowledge ii) Tool selection iii) Tool lifting and installation iv) Auxiliaries Equipment such as hydraulics, pneumatics, electrical and heating systems 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 machine. Demonstrate them how to mount the tool and ask trainees individually to repeat the task. Continue monitor that each student has properly understood the method and performed the required job	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Basic Hand tools Moulding Machine Machine Mould Utility documentation. Service Manuals. Operational Manuals. Basic supplies, such as grease, oil, cleaning agent, emery paper etc.

LU2: Set machine parameters	Deliver an illustrated presentation about how to set machine parameters. Ensure that the presentation focuses on the following key points: i) Moulding cycle from feeding to ejection • Set processing parameters as per job card • Ensure desired temperatures are achieved • Ensure raw material is ready for processing (De-humidified, etc.) • Ensure all peripheral equipments are working properly (oil pump, air filter, hydraulics, motors, pneumatics, etc.) ii) Recognize screw configurations • Check shot size and speed • Check injection pressure and other parameters In the end of the presentation include some multiple-choice questions for the feedback of students After the presentation take the students to the workshop and show them what are the steps to set the machine and how different kind of 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 student has properly understood the method.	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Basic Hand tools Moulding Machine Machine Mould Utility documentation. Service Manuals. Operational Manuals. Basic supplies, such as grease, oil, cleaning agent, emery paper etc.

LU3: Execute Dry Run operation	Begin this session with an illustrated presentation on how to execute dry run. Ensure that the presentation addresses the following points: i) Knowledge and understanding of mould and it's mechanism ii) Understanding of hydraulic and pneumatic systems iii) Manual operation of injection mounding machine iv) Identify runner, gate and clamping v) Identify two plate, slider mould, hot runner mould vi) Identify and set up part ejection in the mould After presentation, take the students in workshop and make them to identify different types of tool angles Demonstrate them the following key points: • How to check open/close mould manually for dry run • How to set heater temperatures Arrange a question and answer session to clarify trainees' understanding. After the practical sessions are complete, lead a feedback session. Ask learners to complete a self-assessment form on their ability to perform facing Ask questions to confirm their understanding. Provide opportunities for trainees to ask their own questions	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Basic Hand tools Moulding Machine Machine Mould Utility documentation. Service Manuals. Operational Manuals. Basic supplies, such as grease, oil, cleaning agent, emery paper etc.
LU4: Produce Sample	Deliver an illustrated presentation on how to produce sample. Ensure that the presentation focuses on the following key points i) Recognize machine controls	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers

	ii) Learn to adjust temperatures from feed zone to injection point iii) Learn to adjust injection pressure iv) Perform Dry-run v) Perform Semi-auto operation vii) Maintaining product quality as per specifications • Be able to measure components for identification of dimensional defects • Usage of measurement tools is critical: Vernier caliper, micrometer gauge, scale, etc. viii) Recognize different defects and their causes • Be able to visually identify commonly occurring defects, such as gating, flashing, orange-peel, etc. • Gain knowledge of rectification of commonly occurring defects. In the end of the presentation include some multiple-choice questions for the feedback of students		Basic Hand tools Moulding Machine Machine Mould Utility documentation. Service Manuals. Operational Manuals. Basic supplies, such as grease, oil, cleaning agent, emery paper etc.
LU5: Verify sample specification	Deliver an illustrated presentation on how to verify sample specification. Ensure you address the importance of the following points: i) Measuring & marking tools • Understand QC protocols • Understand and appreciate the importance of producing products as per specification • Produce samples as per standard ii) Be able to visually identify defects compared to sample specimen • Be able to measure components for identification of dimensional defects	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Basic Hand tools Moulding Machine Machine Mould Utility documentation. Service Manuals. Operational Manuals.

	• Usage of measurement tools is critical: Vernier caliper, micrometer gauge, scale, etc. iii) Check if and when the part is supposed to fit in to other components. iv) Ensure dimensional and mechanical accuracy Prepare either: • A flip chart • A PowerPoint slide • A handout …showing the key topics about sample verification as mentioned above. Go through all the key topics briefly and then allocate **one key topic** to each group. Learners need to work in their small groups discussing the key topic that has been allocated to their group. Each group should use a sheet of flip chart paper to record **three main points** from their discussions that relate to **their key topic**. After the discussion, begin the feedback session. Ask one group to come to the front of the class with their flipchart. Put up the flipchart where it can be easily seen by other learners. Ask the group to share the main points they have recorded for their key topic for perform thread cutting. Discuss these main points briefly with the whole group. Learners should make additional notes **on the flip chart** to record additional points their group had not identified. Then ask the next group to share their flipchart showing the main points they have recorded for the next key		Basic supplies, such as grease, oil, cleaning agent, emery paper etc.

	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 verify sample specifications. Learners must be able to practice and develop their knowledge and skills relating to perform thread cutting Ensure that learners have the opportunity to ask questions to support their understanding		
LU6: Generate Sample report	Deliver an illustrated presentation about sample report generation. Ensure that the presentation focuses on the following key points: i) Production report writing • Understand the importance of reporting accurate production quantity and specifications • Be able to fill-in relevant production reports • Report sample size and percentage of defected products In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Basic Hand tools Moulding Machine Machine Mould Utility documentation. Service Manuals. Operational Manuals. Basic supplies, such as grease, oil, cleaning agent, emery paper etc.

LU7: Take approval for processing	Deliver an illustrated presentation on how to take approval for processing. Ensure you address the importance of the following points: i) Operation of machine in semi-auto and auto mode ii) Optimization of machine parameters for production iii) Data sharing with relevant departments • Understanding the concept of producing accurate data and benefits of the same on a larger scale In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Basic Hand tools Moulding Machine Machine Mould Utility documentation. Service Manuals. Operational Manuals. Basic supplies, such as grease, oil, cleaning agent, emery paper etc.
Module 8: 072200920 Perform Tool Change-over			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Obtain Work Order	Deliver an illustrated presentation on how to obtain work order. Ensure you address the importance of the following points: i) Basic literacy skills • Be able to read instructions about product, quantity and raw material • Be able to identify rolling required to produce different components as per work order ii) Reporting procedure • Understanding the work order contents	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Moulding machine/extruder Mould/die Utility documentation

	• Knowledge of units (Kg, inches, etc.) iii) Work order process • Understand the top-down stream of task assignment • Knowledge of what the work order represents • Who generates the work order? • Where can it be obtained from? iv) Tool handling and storing procedure • Understanding where to obtain desired tool • How to handle mould and dies? v) Set machine parameters as per data sheet provided vi) Be able to input machine parameters as mentioned in work order or datasheet In the end of the presentation include some multiple-choice questions for the feedback of students		
LU2: Prepare tool for production	Deliver an illustrated presentation about how to prepare tool for production. Ensure that the presentation focuses on the following key points: i) Understanding of Tool design and utilities • Identification of correct tools for the job • Softer materials to be used for brushing and cleaning of polished metal surfaces ii) Tool handling protocols • Understanding the concept and appreciating importance of PPEs iii) Tool cleaning protocols In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Moulding machine/extruder Mould/die Utility documentation Basic tools Die/mould handling equipment Safety gear

	After the presentation take the students to the workshop and show them what are the steps to set the prepare the tool for production. 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 student has properly understood the method		
LU3: Carry out tool installation	Deliver an illustrated presentation about install the tool on machine. Ensure that the presentation focuses on the following key points: i) Handling of hand/power tools ii) Understanding of hydraulics/pneumatics and water lines iii) Tool design iv) Tool alignment and fixture v) Training of crane operations 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.	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Moulding machine/extruder Mould/die Utility documentation Basic tools Die/mould handling equipment Safety gear

	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 installation of tool on machine in front of all students. Ask students to observe all the process specially the correct tool angle. Learners must be able to practice and develop their knowledge and skills relating to parting in an appropriate practical setting.		
LU4: Carry out tool storag	Begin this session with an illustrated presentation on tool storage. Ensure that the presentation addresses the following points, including demonstrations of preparation and methods where appropriate: i) Utilization of tool handling accessories, such as cranes, etc. ii) Pre-storage Tool protection treatments iii) Tools transportation SOPs iv) Be able to hand over unused tools to store • Familiarize with handing-over protocols and paperwork. After presentation, take the students in workshop and make them to identify each part of and function of the tool. Demonstrate them the following key points: • Using power tools • Application of anti-rust coatings • How to clean the tool • How to transport the tool	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Moulding machine/extruder Mould/die Utility documentation Basic tools Die/mould handling equipment Safety gear

	After the practical sessions are complete, lead a feedback session. Ask learners to complete a self-assessment form on their ability to perform contouring		

Module 09: 072200921 Perform Shutdown Procedure			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Arrange tools and accessories	Deliver an illustrated presentation about tools and accessories. Ensure that the presentation focuses on the following key points: i) Tool lifting techniques • Training of hand lifting tools • Training on machine based lifting tools • Training of cranes ii) Basic hand tools of machine maintenance and operation • Knowledge of relevant hardware and tools required for the job iii) Plastic Materials • Knowledge of which plastic materials are supposed to be cleared completely out of machines before shutting down iv) Understanding of hydraulic, pneumatic, electrical and heating system • Understanding complete wiring and lines associated with machine In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Service manuals Operational manual Basic hand tools Lifting crane Moulding/extrusion machine Mould/die
LU2: Perform planned shutdown	Deliver an illustrated presentation about how to shut down the machine. Ensure that the presentation focuses on the following key points: i) Vacuum assisted material removing system	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board

	ii) Material feed mechanism iii) Purging process iv) Initiation of Machine shutdown v) Knowledge of lubrication SOP is movable components 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 shutdown machine. Ensure that all students can clearly observe the process and encourage them to ask the questions		Board markers Service manuals Operational manual Basic hand tools Lifting crane Moulding/extrusion machine Mould/die
LU3: Perform Emergency Shutdown	Deliver an illustrated presentation about surface grinding process. Ensure that the presentation focuses on the following key points i) Understand safety protocols ii) Emergency shutdown SOPs iii) Incident report protocols 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 shutdown machine. Ensure that all students can clearly observe the process and encourage them to ask the questions	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Service manuals Operational manual Basic hand tools Lifting crane Moulding/extrusion machine Mould/die

Module 10: 072200922 Manage Product Quality			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Perform inspection	Deliver an illustrated presentation about inspecting plastic products. Ensure that the presentation focuses on the following key points: i) Measuring instruments ii) Awareness of QC protocols iii) Understand and appreciate the importance of producing products as per specification iv) Be able to implement the first quality control protocol on machine to ensure elimination of defective products at sight v) Sample preparation vi) Knowledge standards (BS, ASTM, DIN, etc.) • Understand the difference in producing samples as per multiple standards • Testing machine operation In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Measuring tools and instruments Utility documentation. Service Manuals. Operational Manuals. Basic Hand tools. Computer/ laptop for documentation(latest version with complete office automation software)
LU2: Identify irregularities as per standard	Deliver an illustrated presentation about how to identify irregularities in plastic products. Ensure that the presentation focuses on the following key points: i) Maintaining product quality as per specifications • Be able to measure components for identification of dimensional defects • Usage of measurement tools is critical: Vernier caliper, micrometer gauge, scale, etc. ii) Recognize different defects and their causes	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Measuring tools and instruments Utility documentation.

	• Be able to visually identify commonly occurring defects, such as eccentricity, burn lines, blistering, etc. • Gain knowledge of rectification of commonly occurring defects. In the end of the presentation include some multiple-choice questions for the feedback of students		Service Manuals. Operational Manuals. Basic Hand tools. Computer/ laptop for documentation(latest version with complete office automation software)
LU3: Apply acceptable quality level to product	Deliver an illustrated presentation about acceptable quality level of plastic products. Ensure that the presentation focuses on the following key points: i) Understand corrective protocols to ensure samples pass test ii) Testing standards iii) Testing Machine SOPs iv) Test report generation protocols v) Report generation protocols In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Measuring tools and instruments Utility documentation. Service Manuals. Operational Manuals. Basic Hand tools. Computer/ laptop for documentation(latest version with complete office automation software)
LU4: Prepare quality inspection report	Deliver an illustrated presentation about reporting quality inspection of plastic products. Ensure that the presentation focuses on the following key points: i) Inspection report writing • Understand the importance of reporting accurate production quantity	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers

	• Be able to fill-in relevant inspection reports • Be able to identify waste generated along with identification of machine downtime with reasons ii) Data sharing with relevant departments • Understanding the concept of producing accurate data and benefits of the same on a larger scale • Submission of production reports to production planning department or the operations supervisor for timely actions. In the end of the presentation include some multiple-choice questions for the feedback of students		Measuring tools and instruments Utility documentation. Service Manuals. Operational Manuals. Basic Hand tools. Computer/ laptop for documentation(latest version with complete office automation software)
LU5: Facilitate in auditing	Deliver an illustrated presentation about audit SOPs. Ensure that the presentation focuses on the following key points: i) Document preparation and file maintenance ii) Understand audit protocols In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Audit SOPs Computer/ laptop for documentation

Module 11: 072200923 Manage Production Flow			
Learning Unit	**Suggested Teaching/ Learning Activities**	**Delivery Context**	**Media**
LU1: Plan production schedule	Deliver an illustrated presentation about planning production schedules. Ensure that the presentation focuses on the following key points: i) Understand job card ii) Machine capacity iii) Selection of suitable operator with respect to operational skills iv) Employee Utilization Rate – The percentage of time during which a staff member is actively working versus the number of work hours expected for work v) The optimal amount of time required to generate a single item vi) Inventory Turnover – A ratio that indicates how many instances a firm's inventory is sold and refurbished over a determined time period, which can be measured by dividing the total sales by number of inventory or by dividing the value of products sold (COGS) by average number of inventory available during a specified selling period (monthly, quarterly, yearly) vii) Capacity Utilization Rate – The percentage of the actual manufacturing yield versus the possible manufacturing yield In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Utility documentation. Service Manuals. Operational Manuals

LU2: Ensure raw material and accessories	Deliver an illustrated presentation about plastic raw materials and accessories. Ensure that the presentation focuses on the following key points: i) Material identification ii) Material additives iii) Pigment and dies iv) Product packaging In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Utility documentation. Service Manuals. Operational Manuals
LU3: Ensure machine datasheet	Deliver an illustrated presentation about machine datasheets. Ensure that the presentation focuses on the following key points: i) Machine setup operation ii) Coordination with QC & QA deptt. iii) Measures to improve production methods, equipment performance In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Utility documentation. Service Manuals. Operational Manuals
LU4: Prepare production report	Deliver an illustrated presentation about reporting production of plastic products. Ensure that the presentation focuses on the following key points: i) Compiles, stores, and retrieves production data. ii) Write production and operating reports and resolve operational, manufacturing, and maintenance problems to ensure minimum costs and prevent operational delays. In the end of the presentation include some multiple-choice questions for the feedback of students	Classroom/ Demonstration room Workshop	Multimedia Handouts Learner's guide White board Board markers Utility documentation. Service Manuals. Operational Manuals

Frequently Asked Question

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-5 in Plastic Processor. You shall be able to progress further to National Vocational Certificate Level-5 in Plastic Processor, 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?	You shall be able to take up jobs in the manufacturing and Plastic Processing Industries as a processor for the production of plastic parts and household goods.
6. What are possible career progressions in industry after attaining this certificate?	You shall be able to progress up to the level of shop supervisor after attaining sufficient experience, knowledge and skills during the job.

	Attaining additional relevant qualifications may aid your career advancement to even higher levels.
7. Is this certificate recognized by any competent authority in Pakistan?	This certificate is based on the nationally standardized and notified competency standards by National Vocational and Technical Training Commission (NAVTTC). The official certificates shall be awarded by the relevant certificate awarding body.
8. Is on-the-job training mandatory for this certificate? If yes, what is the duration of on-the-job training?	On-the-job training is not a requirement for final / summative assessment of this certificate. However, taking up on-the-job training after or during the course work may add your chances to get a job afterwards.
9. What is the examination / assessment system in this program?	Competency based assessments are organized by training institutes during the course which serve the purpose of assessing the progress and preparedness of each student. Final / summative assessments are organized by the relevant qualification awarding bodies at the end of the certificate program. You shall be required to be declared "Competent" in the summative assessment to attain the certificate.
10. Does this certificate enable me to work as freelancer?	You can start your small business as a Plastic Processor. You may need additional skills on entrepreneurship to support your initiative.

Short Questions/Answers

Q1. What Are the Important Characteristics of Plastics?	It can be molded into finished product by application of heat and pressure.
Q2. What Are the Advantages of Plastics Over Metals?	• Low weight • Corrosion resistance • Insulation properties • Electrical properties • Cheaper • Easy to handle • Surface properties • Reusable
Q3. What is the difference between parallel and conical twin screw extruders?	Conical twin screws are used for better throughput and parallel twin screws are used for better mixing.
Q4. Explain the Disadvantages of Plastics?	• Low strength • Low heat resistance • Poor mechanical properties • Difficulty to repair
Q5. Types of Plastics Based on Chemical Behavior?	• Thermo plastics • Thermosetting plastics
Q6. Difference Between Thermoset and Thermoplastics?	Thermoplastics: • Can be re softened and reused • No chemical changes during heating. • In granular form • Needle structure • Hard but not brittle Thermo set plastics: • Cannot be re softened and reused • Chemical changes during heating etc. • In powder form

	• Cross linked structure • Hard and brittle
Q7. What is MFI?	Flow capacity of different grades of thermoplastics are inversely proportional to molecular weight.
Q8. Examples for Thermosetting Materials?	Alkyds, epoxies, pf, mf, urea, polyester, etc.
Q9. What are Fillers and Additives?	Adding of small molecules to plastics to get some characteristics (color, flexibility etc.). Fillers are commonly used with thermosetting plastics. Additives are of two types, • Physical means such as plasticizer • Chemical means--- stabilizer.
Q10. What are the Mold Release Agents?	• External with mold surface e.g. Polyvinyl alcohol • Internal with resins e.g. Silicon oil
Q11. What are the Types of Injection Molding Machines?	• Plunger injection cylinder • Two stage plunger injection cylinder • Pre plasticizer two stage screw injection cylinder • Reciprocating screw injection cylinder
Q12. What are the Divided Sections of Screw of Injection Molding Machines?	• Feed zone • Compression zone • Melting zone
Q13. What do you mean by Nozzle?	Nozzle connected to the end of the barrel through which soften materials inserted in the mold.
Q14. What are the Types of Nozzle?	• Reverse taper (melt valve) - for PA, ABS, etc. • Removable tip • Standard of general purpose
Q15. Define Drooling?	Leakage of plastic material through the nozzle in between shots.
Q16. What is Injection Capacity or Short Capacity?	Maximum volume material injected by the screw during one cycle of operation.

Q17. What is Plasticizing Capacity?	It is the amount of material that can be processed by the machine per hour. It is expressed in kg/h.
Q18. What is Injection Pressure?	It is the maximum pressure by which the material is injected through the nozzle. It is given in kg/cm^2.
Q19. What is Injection Rate or Injection Velocity?	It is the maximum rate at which the screw can inject or shoot materials from the barrel during one shot.
Q20. What do You Meant by Clamping Force?	It is the maximum force that the clamping system can exert on the mold or it is the maximum force by which the mold halves can be closed together. It is given in ton or kilo Newton.
Q21. What is Maximum Daylight?	It is the maximum distance that the machine platen can be separated from each other and it can be obtained by adding the maximum mold thickness to the maximum opening stroke.
Q22. What is a Mold?	It is a custom build tool in which converts plastic raw material into finished product.
Q23. What are the Main Elements of Mold?	The main parts of molds are core and cavity.
Q24. What are the General Types of Mold?	Injection molds, compression molds, transfer molds.
Q25. What are the Types of Injection Mold?	• Two plate mold • Three plate mold • Hot runner mold • Insulated runner mold • Hot manifold mold • Stacked mold
Q26. What is Two Plate Mold?	Mold which consists of core and cavity situated in plates. It is logical type tool where component require large gate. For simple type components there is only one daylight.
Q27. What is 3 Plate Mold?	It consists feed plates with core and cavity.
Q28. What is Hot Runner Mold?	In this, runner kept hot to keep the molten metal into fluid state also called runner less mold. In this, runner contained in a plate of its own runner section of the mold is not opened during molding cycle.
Q29. Note down the Advantages of Runner Mold?	• No molded side products

	• No separating of gate • Cycle time can be reduced
Q30. What is Insulated Runner Mold?	It is a variation of hot runner mold in this type of molding. The outer surface of the material in the runner acts as a insulator.
Q31. What is Hot Manifold Mold?	This is a variation of the heated hot runner and not the runner plate. This is done using electric cartridge.
Q32. What do You Meant by Stacked Mold?	A stacked mold is a multiple two plate mold with mold placed one over the other. A stacked mold construction doubles the output from a single molding machine and requires the same clamping force.
Q33. Explain about Injection Molding?	In this process, the plastic material is injected in to the mold through a sprue bush by means of a screw plunger. This process can be used for both thermosetting and thermoplastic materials.
Q34. What is Compression Molding?	In this process, the plastic material is placed in the cavity and use a force for compressing the compound as the mold closes, these molds are generally used for thermosetting materials.
Q35. What is Transfer Mold?	In this process, the plastic material is transferred from a transfer pot and then forced in to the cavity by means of plunger. This method is used for molding thermosetting materials only.
Q36. Explain Vacuum Molding?	The mold used for this process is similar that of the female half of the compression or blow mold auxiliary equipment on the machine heats the material and drags it over the cavity as indicated by the precise technique chosen.
Q37. What do You Meant Cavity?	Female portion of the mold and it gives external form.
Q38. What is Core?	Male portion of the mold and it gives internal form.
Q39. What is Sprue Bush?	Connecting member between register ring and runner.
Q40. What is Gate?	Connecting member between impression and runner.
Q41. What is A Quality Management Plan (QMP)?	A QMP is a formal plan that documents an entity's management system for the environmental work to be performed. The QMP is an "umbrella" document which describes the organization's quality system in terms of the organizational structure, functional responsibilities of management and staff,

	lines of authority, and required interfaces with those planning, implementing, and assessing all environmentally related activities conducted.
Q42. What are the Benefits of Quality Management System?	• Improvement in internal quality (reduction in scrap, rework and non-conformities in the shop) • Improvement in external quality (customer satisfaction, claims of non-conforming products, returned products, warranty claims, penalty claims etc) • Improvement in Production reliability (number of break downs, percentage down time etc) • Improvement in Time performance (on-time delivery, time to market etc) • Reduction in the cost of poor quality (external non-conformities, scrap, rework etc)
Q43. In the region, where there is no Quality Management, what would you do to introduce the concept of TQM?	Where Quality processes are not available, I would encourage them to identify and document their each and every task for each process. Then, I would encourage them to define and document what they can do for minimizing human or machine errors. I would encourage them to identify wastage's like material or time wasters and define process to minimize these wastages. I would ask them to record and document each finding and strive to improve each process.
Q44. What is the difference between Quality Assurance and Quality Control?	**Quality Assurance:** ○ It is an Assurance activity, emphasizing on the standards and procedures to be followed while developing an application ○ It is a Preventive action taken before hand to ensure the product that developed are defect free ○ It is a systematic action necessary to provide enough confidence that a product or service will satisfy the given requirements for quality. **Quality Control:** ○ It is a Corrective action ○ Inspection if the developed application follows the standards and procedures by using the checklists.

Q45. Differentiate between Product Quality and Process Quality?	Product quality means we concentrate always final quality but in case of process quality we set the process parameter
Q46. What does 6 Sigma Represent?	Meaning 99.999997% perfect; only 3.4 defects in a million.
Q47. How might the Operations Manager (you) be Involved with Individual Employees Morale?	Oftentimes this question gauges whether someone understands the position of operations manager and has a decent understanding of what scope the job entails. An operations manager has to deal with small scale conflicts, discipline, and office regulations. Oftentimes this means effectively communicating with/being attentive to, individual employees to ensure that personal conflicts or grievances are allayed. Be prepared to be asked about specific examples where a decision that you made influenced a situation either positively or negatively.

Test Yourself (Multiple-choice Questions)

MODULE	7		
Question	**1**	Three overall classes of plastics are distinguished from one another. They include thermosets, thermoplastics and _____	A Monomers B Synthesis C Elastomers D Fibers
Question	**2**	Thermoplastics are soluble and _____	A Densely cross-linked B Fusible C Non-fusible D Crystalline

Question 3 Amorphous thermoplastics are _____ when they are not combined with fillers or similar additives.

A Transparent

B Milky opaque

C Translucent

D Black

Question 4 Polycarbonate (PC), from which Compact Disks are molded, is a(n) _____ thermoplastic.

A Amorphous

B Semi-crystalline

C Liquid Crystal

D Immiscible

Question 5 _____ cannot be fused or dissolved but can be swelled.

A Thermoplastics

B Elastomers

C Thermosets

D Composites

Question 6 Thermosets are non-fusible and _____

A Soft

B Densely cross-linked

C Dense

D Irregular shaped

Question 7 The intermolecular forces which operate in the crystalline state are considerably _____ than those in the amorphous state.

A Weaker

B Stronger

C Complex

D Diverse

Question 8 The abbreviation for polyamide, as specified by IS0 1043, is _____

A PS

B PA

C PC

D PVA

Question 9 Processing temperatures are _____ for thermoplastics than for metals.

A Higher

B Lower

C Left

D Right

Question 10 Viscosity is a measure of the _____ of a melt.

A Hardness

B Flow properties

C Density

D Visco-elasticity

Question 11 As temperature decreases, the viscosity of the melt _____

A Increases

B Decreases

C Varies

Question 12 The injection Moulding process can be divided into the following phases: injection, holding pressure, cooling, feeding and _____.

A Locking

B Removal

C Cleaning

D Closing

Question 13 The nozzle is _____ during the injection phase.

A Closed

B Open

C Perforated

D Ejected

Question 14 The screw moves towards the _____ during the injection phase.

A Hopper

B Nozzle

C Pump

D Motor

Question 15 Compensation for shrinkage occurs during the _____ phase.

A Injection

B Holding pressure

C Feed

D Metering

Question	**16**	The _____ phase runs concurrently with the feed phase.	A	Cooling
			B	Injection
			C	Holding pressure
			D	Metering
MODULE	**8**			
Question	**17**	Which of the following material is not used in extrusion?	A	Wax
			B	Granules
			C	Powder
			D	Pellets
Question	**18**	In blow molding, to inflate soft plastic, which medium is used?	A	Air
			B	Water
			C	Oil
			D	Alcohol

Question 19 Which of the following plastics is not used in blow molding?

A Terephthalate

B Polyethylene

C Polypropylene

D PVC

Question 20 Which of the following is not a type of blow molding process?

A Injection Blow Moulding

B Extrusion Blow Moulding

C Multi-smaller blow moulding

D Multi-larger blow moulding

Question 21 What is the minimum thickness required by the plastic for vacuum forming?

A 0.125mm

B 0.25mm

C 0.375mm

D 0.5mm

MODULE	**9**			
Question	**22**	Which of the following material is not used in purging?	A	Wax
			B	PE
			C	PP
			D	PC
Question	**23**	What is the ideal temperature for purging?	A	230°C
			B	190°C
			C	250°C
			D	T_g
Question	**24**	Purging is done to remove what from machines?	A	Contaminants
			B	Residual material
			C	Burnt material
			D	All of the above

MODULE	**10**			
Question	**25**	What was the transcendent view of quality?	A	Satisfying customers
			B	Meeting needs and wants
			C	Innate excellence
			D	Conformance
Question	**26**	What the organization must accomplish to achieve the mission, by examination and categorization of the impacts?	A	Critical success factors
			B	Key process indicators
			C	Legal and policy factors
			D	The enemy indicator

Question 27 Which of the following should be used as input to management review in order to ensure that continual improvement is the driver for organizational development?

A Performance information

B Performance management

C Ethical performance

D Performance development

Question 28 Which of the following statements holds true for quality assurance?

A Top management's intention regarding quality

B Functions determining implementation of the quality policy

C Actions to provide confidence of satisfying quality requirements

D Responsibilities and processes, which implement quality management

Question 29 Which of the following models has a vertical chain of command?

A Organism model

B Mechanistic model

			C Cultural model
			D Total quality model
MODULE	**11**		
Question	**30**	Operations management involves the functions of planning, organizing, controlling etc, in production systems. The activity of encouraging employees through praise, recognition and other intangibles is part of which function?	A Controlling
			B Motivating
			C Coordinating
			D Organizing
Question	**31**	Decisions on production and process design, facility location and layout etc, are part of which decision category?	A Strategic decisions
			B Tactical decisions

C Operational decisions

D All of the above

Question 32 The decision of an operations manager about what products to make and when is part of which function?

A Organizing

B Directing

C Planning

D Coordinating

Question	**33**	Operations Management involves the activities of planning, organizing, controlling, directing, and coordinating in production systems. These systems convert resource inputs into products or services. Centralization and/or decentralization of operations fall under which of the following activities?	A Organizing B Directing C Planning D Coordinating
Question	**34**	Who generally develops corporate objectives that are unique to each organization?	A Front line managers B Top-level managers C Middle level managers D Production supervisors
Question	**35**	What is the basic use of a prototype during the new product development process?	A A prototype is used to test the technical and economical feasibility B A prototype helps test the product performance under standard conditions C A prototype is developed as part of test marketing D None of the above
Question	**36**	Work standards techniques generally find use in which of the following operations?	A Operations planning B Operations scheduling C Operations control D All of the above

Question 37 Organizations generally use demand forecasts to develop which of the following plans?

A Financial plans

B Facilities plan

C Marketing plans

D All of the above

Multiple-choice Questions Answer scheme

Module 7:

Q1: C
Q2: B
Q3: B
Q4: B
Q5: C
Q6: B
Q7: B
Q8: B
Q9: B
Q10: B
Q11: A
Q12: B
Q13: B
Q14: B
Q15: B
Q16: D

Module 8:

Q17: A
Q18: A
Q19: A
Q20: C
Q21: C

Module 9

Q22: B
Q23: A
Q24: D

Module 10

Q25: D
Q26: B
Q27: A
Q28: C
Q29: A

Module 11

Q30: B
Q31: A
Q32: C
Q33: A
Q34: B
Q35: B
Q36: C
Q37: A

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