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ROBOTICS TECHNICIAN



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CBT Curriculum
National Vocational Certificate Level 4

Version 1 - October, 2019

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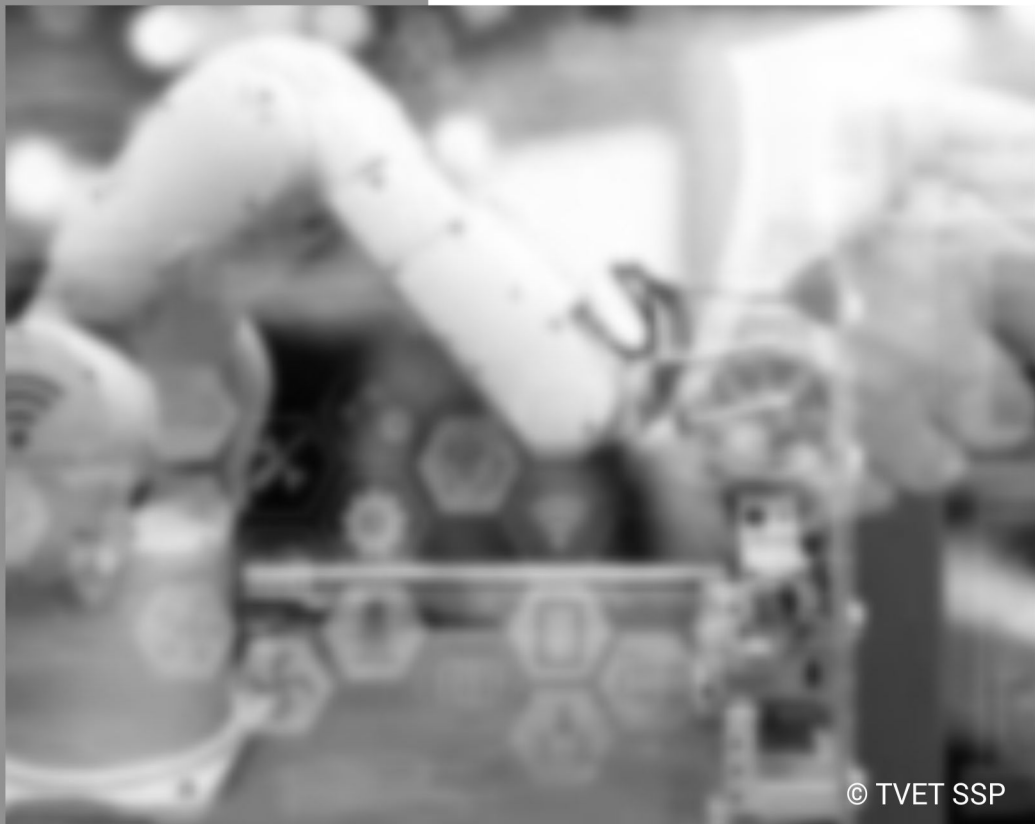
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Introduction

Definition/ Description of the training program for Robotics Technician

In order to build the capacity of technical and vocational training institutes in Pakistan through provision of demand driven competencies-based trainings in Electronics sector the NAVTTC, and TEVT Sector Support Program (TSSP) have joined hands together to develop qualifications for Electronics sector. These qualifications will not only build the capacity of existing workers of this sector but also support the youth to acquire skills best fit for this sector. The benefits and impact of development of these qualifications will be on both demand and supply side.

This Curriculum is meant for individuals striving to enter the field of “Robotics Technician”. This course builds the basic qualification that is essential for any robotics technician to effectively carry out their duties.

The curriculum will provide students with the necessary knowledge and skills to operate robots and robotic systems in an industrial setting as well as to monitor their operation. The students will have sufficient understanding to deploy, commission, test and maintain robots and robotics systems.

Trainees will also learn how to perform assembly of robots and robotics systems along necessary configuration and up-gradation. Trainees will develop essential understanding which will enable them to troubleshoot robots and robotics systems whenever the need arises.

This course will also cover essential soft skills such as project management, quality assurance, health and safety etc. enabling the individual to become an asset for their organization.

Objectives

The specific objectives of developing these qualifications is as under:

- Develop basic knowledge and understanding which enables trainees to operate robots and robotic systems effectively
- Have the necessary understanding to effectively monitor and coordinate robots and robotic systems
- Enable trainees to properly maintain and troubleshoot robots
- Perform initial deployment and commissioning of robotic systems
- Acquire necessary skills to assemble and test robots and robotics systems
- Have sufficient knowledge to carry out configuration of robots and robotic systems as well as up-gradation of said system

Based upon this demand of industry these competency-based qualifications for ROBOTICS TECHNICIAN are developed under National Vocational Qualification Framework (NVQF) (Level 1 to 4). The qualifications mainly cover competencies along with related knowledge and professional skills which are essential for getting a job or self-employed.

The qualifications are also in line with the vision of Pakistan’s National Skills Strategy (NSS), National TVET Policy and National Vocational Qualification Framework (NVQF). This provides policy directions, support and an enabling environment to the public and private

sectors to impart training for skills development to enhance social and economic profile. The National Vocational & Technical Training Commission (NAVTTTC) has approved the Qualification Development Committee (QDC). The QDC consists experts from the relevant industries from different geographical locations across Pakistan and academicians who were consulted during the development process to ensure input and ownership of all the stakeholders. The National Competency Standards could be used as a referral document for the development of curricula to be used by training institutions.

Purpose of the training program

The competency based NVQ has been developed to train the unskilled youth of Pakistan on the technical and administrative skills to be employed and sustain impact on their livelihood through income generation.

The purpose of these qualifications is to set professional standards for Robotics Technicians, who will serve as key agents to enhance quality of Pakistan's robotics, technology, and manufacturing industries.

Overall objectives of training program

The Robotics Technician qualifications level 1- 4 consists of theoretical and practical details required for Robotic Technician in Electronics industries. However, this will require providing additional input on entrepreneurship development for the one who is willing to start his/her own business. The main objectives of the qualification are as follows:

- Develop knowledge, skills and understanding related with basic and operational robotics functionalities that lead to and demonstrate conceptual and technical accomplishment
- Provide sound introduction about robotics technician technical, functional and generic skills
- Introduce the concepts of industrial robots and explains how they can be used in a plant or manufacturing system
- Support to acquire specialist knowledge and practical experience required for robotics technician
- Encourage trainees to test and explore different software and associated technical resources for knowledge, understanding and implementation
- Offers the wide range of interactive learning elements to provide trainees with a rich learning experience

Competencies to be gained after completion of course

At the end of the course, the trainee must have attained the following competencies:

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Certificate Level-4

0714 E&A 023

Robotics Technician

(Junior Supervisor)

- Supervise juniors for transfer of knowledge
- Assure team productivity
- Perform maintenance of robotics
- Perform trouble shooting
- Revise the configuration of robotics
- Execute up-gradation of robotics system
- Develop 3D simulations
- Assist engineers in design, configuration and application processes
- Ensure product quality
- Upgrade professional and technical knowledge about robotics
- Analysis workplace policy and procedures
- Contribute to work related health and safety (WHS) initiatives
- Perform advanced communication
- Develop advance computer application skills
- Manage human resource services
- Develop entrepreneurial skills

1. Supervise juniors for transfer of knowledge
2. Assure team productivity
3. Perform maintenance of robotics
4. Perform trouble shooting
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6. Execute up-gradation of robotics
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10. Upgrade professional and technical knowledge about robotics
11. Analysis workplace policy and procedures
12. Contribute to work related health and safety (WHS) initiatives
13. Perform advanced communication
14. Develop advance computer application skills
15. Manage human resource services
16. Develop entrepreneurial skills

Possible available job opportunities available immediately and later in the future

Robotics Technician are employed in the light engineering sector especially in Electronics and Mechatronic sector. Experienced **Robotics Technician** may advance through promotions with the same employer or by moving to more advanced positions with other employers. They can become:

- Robotics Technician
- Robotics Technician (Jr. Supervisor)
- Robotics Technician (Junior Technician)
- Robotics Technician (Helper)

Trainee entry level

- Minimum Middle for level 1
- Minimum Middle for level 2
- Minimum 9th/Level-2 for level 3
- Minimum 9th/Level-3 for level 4

Minimum qualification for trainer

- Must hold DAE/Higher in (Electrical/Telecom/Electronics/Equivalent) with at least one years of experience in Robotic Industry.
- Or at least level 4 qualification in **(ROBOTICS TECHNICIAN)** with minimum 03 years of experience in relevant field.

Recommended trainer: trainee ratio

The recommended maximum trainer: trainee ratio for this program is 1 trainer for 20 trainees

Medium of instruction i.e. language of instruction

Instructions will be in Urdu/English/Local language.

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

This curriculum comprises of 49 modules. The recommended delivery time is 2400 hours.

- Delivery of the course can therefore be full time (4 hours a business day), 6 days a week, for 24 months (on average 26 working days a month) for each level. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery. **OR**
- Delivery of the course can therefore be full time (5 hours a business day), 5 days a week, for 24 months (on average 22 working days a month). 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 follows:

Module	Theory hours	Workplace hours	Total hours
Supervise juniors for transfer of knowledge			30
Assure team productivity			30
Perform maintenance of robotics	10	40	50
Perform trouble shooting	12	48	60
Revise the configuration of robotics	10	40	50
Execute up-gradation of robotics	8	42	50
Develop 3D simulations	8	32	40
Assist engineers in design, configuration and application processes	6	24	30
Ensure product quality			30
Upgrade professional and technical knowledge about robotics			30
Analysis workplace policy and procedures			30
Contribute to work related health and safety (WHS) initiatives			30
Perform advanced communication			30
Develop advance computer application skills			40
Manage human resource services			20
Develop entrepreneurial skills			30

Sequence of the modules

This qualification is made up of 49 modules. A suggested distribution of these modules is presented overleaf. This is not prescriptive and training providers may modify this if they wish.

The following technical module will be followed as require for the training purpose.

Sr#	Competency Standard	Level	Credit Hrs.	Category
1	Supervise juniors for transfer of knowledge	4	03	Functional
2	Assure team productivity	4	03	Functional
3	Perform maintenance of robotics	4	05	Technical
4	Perform trouble shooting	4	06	Technical
5	Revise the configuration of robotics	4	05	Technical
6	Execute up-gradation of robotics	4	04	Technical
7	Develop 3D simulations	4	04	Technical
8	Assist engineers in design, configuration and application processes	4	04	Technical
9	Ensure product quality	4	03	Functional
10	Upgrade professional and technical knowledge about robotics	4	03	Functional
11	Analysis workplace policy and procedures	4	03	Generic
12	Contribute to work related health and safety (WHS) initiatives	4	03	Generic
13	Perform advanced communication	4	03	Generic
14	Develop advance computer application skills	4	04	Generic
15	Manage human resource services	4	02	Generic
16	Develop entrepreneurial skills	4	03	Generic

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 demand of Pakistan that make this qualification unique to Pakistan's industry needs.

Summary – overview of the curriculum

Modules

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Perform maintenance of robotics	LU1 Develop maintenance schedule LU2 Perform maintenance as per procedure standards and guideline LU3 Supervise maintenance staff LU4 Ensure timely maintenance to avoid negative outcomes LU5 Perform component / functionality test after maintenance LU6 Generate maintenance report	10	40	50
Perform trouble shooting	LU1 Identify the problem LU2 Gather more details related to problem LU3 Identify possible solutions LU4 Attempt a fix based on findings LU5 Generate diagnostic report	12	48	50
Revise the configuration of robotic system	LU1 Verify detailed functionality of equipment LU2 Verify detailed functionality of interface	10	40	50

	LU3 Identify task that require re-configuration of equipment LU4 Ensure integration of reconfigured equipment LU5 Upgrade software modules LU6 Ensure testing and smooth functionality of equipment			
Execute up-gradation of robotic system	LU1 Identify current state of equipment for up-gradation LU2 Recommend up-gradation of specific equipment LU3 Install / replace software modules LU4 Install / replace physical components LU5 Perform post up-gradation test LU6 Ensure expected outcomes	8	42	50
Develop 3D simulations	LU1 Manage 3D modelling tools LU2 Build models in 3D environment LU3 Simulate 3D models LU4 Convert / generate coordinating system for 3D model LU5 Test generated G-Code	8	32	40

Assist engineers in design, configuration and application processes	LU1	Execute repetitive/ manual design process	6	24	30
	LU2	Manage tools and equipment			
	LU3	Execute test plan			

Module: 0714001072 Perform maintenance of robotics

Objective of the Module: This Competency Standard identifies the required skills and knowledge to adopt for maintenance of robotic systems. After completing this competency trainee will be able to develop maintenance schedule, perform maintenance, supervise and ensure maintenance as per standard procedures. Trainee will also be able to perform post maintenance test to ensure proper working.

Duration:	Total hours 50	Theory:	10hrs	Practical	40hrs
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Module: 0714001073 Perform trouble shooting

Objective of the Module: This competency standard deals with identification and rectification of the problem occurred in the robotic system. The learner will be able to identify and resolve the problem according to the troubleshooting manual. It also helps the learner to prepare a comprehensive diagnostic report of the troubleshooting.

Duration:	Total hours 60	Theory:	12	Practical	48
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Identify the problem	The trainee must be able to: <ul style="list-style-type: none"> Examine the robotic system. Enlist the identified 	<ul style="list-style-type: none"> Describe the steps to examine the robotic system. Describe the list of common problems of 	Total: 9 hrs. Theory:2 hrs. Practical:9 hrs.	<ul style="list-style-type: none"> Tool Kit (Electrical and Mechanical) Robotic Platform Computers Printers 	Class Room/Lab

	<p>problems.</p> <ul style="list-style-type: none"> Classify the problems. 	<p>a robotics system and their categories</p>		<ul style="list-style-type: none"> Notepads 	
		<p>Practical</p> <ul style="list-style-type: none"> Examine the robotic system and identify problem and its category 			
LU2. Gather more details related to problem	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Identify reasons for the specified problem. Observe the parameters and conditions at the time of problem occurred. Prepare a detailed report on the problem. 	<ul style="list-style-type: none"> Describe the list of problems and causes. Describe variations in parameters robot condition, during anomaly Demonstrate report preparation to highlight problems in robotic system, variations in parameter and identified causes. 	<p>Total: 9 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:9 hrs.</p>		Class Room/Lab
		<p>Practical</p> <ul style="list-style-type: none"> Implement detailed report to highlight problems in robotic system, variations in parameter and 			

		identified causes.			
LU3. Identify possible solutions	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Identify the troubleshooting manual. • Specify the corrective measures from the troubleshooting manual. • Arrange tools and equipment required to attempt fixing the problem. 	<ul style="list-style-type: none"> • Describe the usage of troubleshooting manual. • Describe the corrective measures for troubleshooting using manual. • Describe tools and equipment required to attempt fixing the problem. • Demonstrate the usage of troubleshooting manual. • Demonstrate the corrective measures for troubleshooting using manual and equipment required to attempt fixing the problem. 	<p>Total: 9 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:9 hrs.</p>		Class Room/Lab
		Practical			

		<ul style="list-style-type: none"> Implement troubleshooting using manual and equipment required to attempt fixing the problem. 			
LU4. Attempt a fix based on findings	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Follow instructions from troubleshooting manual to resolve the problem. Gather more information and repeat if the problem is not resolved. Make a detailed report on rectification of the problem. 	<ul style="list-style-type: none"> Explain instructions from troubleshooting manual. Describe the detailed report on rectification of the problem. Demonstrate troubleshooting using manual and repeat if the problem is not resolved. Demonstrate detailed report on rectification of the problem. 	Total: 16 hrs. Theory:4 hrs. Practical:12 hrs.		Class Room/Lab
		Practical <ul style="list-style-type: none"> Troubleshoot problems using manual and repeat if the problem is not 			

		<p>resolved.</p> <ul style="list-style-type: none"> • Create a detailed report on rectification of the problem. 			
LU5. Generate diagnostic report	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Note the parameters and conditions after fixing the problem. • Prepare a comprehensive report on the observations and rectification of the problem. • Maintain error logs. 	<ul style="list-style-type: none"> • Describe parameters and conditions that indicate cause of problem and their normal state after fixing the problem. • Describe the report on the observations and rectification of the problem. • Describe error logs. • Demonstrate identification of parameters and conditions that indicate cause of problem and their normal states after fixing the problem. • Demonstrate report on the observations and rectification of the problem and error logs. 	Total: 9 hrs. Theory:2 hrs. Practical:9 hrs.		Class Room/Lab
		Practical			

		<ul style="list-style-type: none"> Implement identification of parameters and conditions that indicate cause of problem. Implement report on the observations and rectification of the problem and error logs. 			
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Module: 0714001074 Revise the configuration of robotics

Objective of the Module: This Competency Standard covers the required skills and knowledge for revising configuration of the robotic system according to the need of specified task. The trainee will be able to learn how to identify and reconfigure software and hardware modules of the robotic system as per desired task.

Duration:	Total hours	50 Hrs	Theory:	10 Hrs	Practical	40 Hrs
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Verify detailed functionality of equipment	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Identify functionality tests for checking robot Perform functionality test for robot Ensure proper functionality of the 	<ul style="list-style-type: none"> Describe functionality tests Describe the procedure for conducting functionality tests Demonstrate functionality tests Practical Given a robotic equipment, perform functionality 	<p>Total: 7 hrs.</p> <p>Theory:1 hr.</p> <p>Practical:6 hrs.</p>	<p>Robotic System</p> <p>Mechanical Tool Kit</p> <p>Electronic Tool Kit</p> <p>Laptops</p>	Class Room/Lab

	equipment	tests as per requirement to verify that ii is functioning properly			
LU2. Verify detailed functionality of interface	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Identify interfacing modules for robot Perform functionality test Ensure proper functionality of the interface modules 	<ul style="list-style-type: none"> Describe various interfaces of robotic components Describe various functionality tests for testing the functionality of interfaces Demonstrate functionality tests of interfaces <p>Practical</p> <ul style="list-style-type: none"> Given robotic components with various interfaces, perform functionality testing of those interfaces to ensure proper functionality 	<p>Total: 8 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:6 hrs.</p>		Class Room/Lab
LU3. Identify task that require re-configuration of equipment	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Specify the task which will require re configuration . List required tool and equipment for reconfiguration. List down 	<ul style="list-style-type: none"> Describe various configurations of robotic systems Demonstrate how to identify tasks that require reconfiguration Describe tools and equipment that can be used for reconfiguration Describe various 	<p>Total: 8 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:6 hrs.</p>		Class Room/Lab

	robotic components necessary for reconfiguration	<p>robotic components that can be used for reconfiguration.</p> <p>Practical</p> <ul style="list-style-type: none"> Given a robotic system that needs to be reconfigured for some other task, identify the components that require reconfigurations and provide a list of equipment, tools and robotic components that will be required 			
LU4. Ensure integration of reconfigured equipment	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Arrange robotic components necessary for reconfiguration Identify standard procedure for integration Perform integration of reconfigured equipment 	<ul style="list-style-type: none"> Describe robotics components that can be reconfigured Describe the standard procedure for reconfiguring robotic component Describe the procedure for performing integration Demonstrate integration of reconfigured components <p>Practical</p> <ul style="list-style-type: none"> Given a robotic system with reconfigure components, perform integration of the 	<p>Total: 10 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:8 hrs.</p>		Class Room/Lab

		reconfigured components			
LU5. Upgrade software modules	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Identify software modules that require up gradation Backup existing software and configuration Perform up gradation of software modules according to the SOP. 	<ul style="list-style-type: none"> Describe procedure for backup of software and configuration Describe procedure for upgradation of software modules Describe procedure for identify software modules that required upgradation Demonstrate backup of software and configuration Demonstrate upgradation of software modules <p>Practical</p> <ul style="list-style-type: none"> Given a robotic system, perform backup of the existing software and configuration. Identify modules that require upgradation and perform upgradation of those modules 	<p>Total: 10 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:8 hrs.</p>		Class Room/Lab
LU6. Ensure testing and smooth functionality of equipment	<p>The Trainee must be able to:</p> <ul style="list-style-type: none"> Identify standard testing 	<ul style="list-style-type: none"> Describe standard testing procedures Describe standard procedure 	<p>Total: 8 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:6 hrs.</p>	As unit-1	Class Room/Lab

	procedures. <ul style="list-style-type: none"> • Perform functionality test of the reconfigured equipment • Ensure proper functionality of the reconfigured equipment • Maintain log of equipment reconfiguration 	for maintaining log <ul style="list-style-type: none"> • Demonstrate functionality testing of reconfigured component • Demonstrate maintaining equipment log Practical <ul style="list-style-type: none"> • Given a reconfigured robotic system, perform functionality testing of the reconfigured components and prepare reconfiguration log 			
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Module: 0714001075 Execute up-gradation of robotics

Objective of the Module: This Competency Standard covers the required skills and knowledge for execution of up-gradation of robotic equipment. The trainee will be able to learn about identification process of equipment up-gradation, installation of software, hardware components and post operating tests.

Duration:	Total hours	50	Theory:	8	Practical	32
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Identify current state of equipment for up-gradation	The Trainee must be able to: <ul style="list-style-type: none"> • Identify reason for up-gradation of equipment • Identify tasks and related component 	<ul style="list-style-type: none"> • Describe the advancement in Robotics Instrumentation • Summarize the production difference using 	Total: 10 hrs. Theory: 2 hrs. Practical: 8 hrs.	<ul style="list-style-type: none"> • Robotic system • Mechanical tool kit • Electrical tool Kit • Personal Computers / Laptops 	Class Room/Lab

	<p>that need up-gradation</p> <ul style="list-style-type: none"> • Ensure need to upgrade equipment 	<p>advance instruments</p> <ul style="list-style-type: none"> • Explain rate of increase of production rate using upgraded equipment . 		<ul style="list-style-type: none"> • Notebook 	
LU2. Recommend up-gradation of specific equipment	<p>The Trainee must be able to:</p> <ul style="list-style-type: none"> • List components of equipment need to be upgraded • List the new upgraded equipment • Prepare report on recommended equipment 	<ul style="list-style-type: none"> • Identify the upgrade able instruments and their substandard. • Describe briefly the advance technology regarding the factory plant. • Illustrate the extended features of recommended instruments. 	<p>Total: 10 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:8 hrs.</p>	As unit-1	Class Room/Lab
LU3. Install / replace software modules	<p>The Trainee must be able to:</p> <ul style="list-style-type: none"> • Identify software module that needs 	<ul style="list-style-type: none"> • Outline out-dated features of software module. • Explain 	<p>Total: 10 hrs.</p> <p>Theory:2 hrs.</p>	As unit-1	Class Room/ Lab

	replacement <ul style="list-style-type: none"> Follow standard procedure for up-gradation of software modules Report software modules upgraded 	step by step procedure of software update. <ul style="list-style-type: none"> Describe how to prepare report of software up gradation. 	Practical:8 hrs.		
LU4. Install / replace physical components	The Trainee must be able to: <ul style="list-style-type: none"> Identify physical component that need replacement Follow standard procedure for up-gradation of physical modules Report physical components upgraded Ensure proper packaging and storage of replaced modules 	<ul style="list-style-type: none"> Outline out-dated key points of physical component. Explain step by step procedure of physical module up gradation. Illustrate how to prepare report for physical module up gradation. Interpret industrial storage system for warehouses. 	Total: 10 hrs. Theory:2 hrs. Practical:8 hrs.	As unit-1	Class Room/Lab
LU5. Perform post up-gradation test	The Trainee must be able to: <ul style="list-style-type: none"> List post up-gradation tests Follow post up-gradation test as per 	<ul style="list-style-type: none"> Summarize post up gradation techniques for particular robot. Describe step by step 	Total: 10 hrs. Theory:2 hrs. Practical:8 hrs.	As unit-1	Class Room/Lab

	standard operating procedure <ul style="list-style-type: none"> Evaluate and report post up-gradation tests results 	procedure for up gradation. <ul style="list-style-type: none"> explain how to generate report for an up graded system. 			
LU6. Ensure expected outcomes	The Trainee must be able to: <ul style="list-style-type: none"> List expected outcome of up-gradation Compare expected and evaluated post up-gradation results Ensure corrective measures to achieve expected outcome 	<ul style="list-style-type: none"> Explain the expected changes after up gradation. Determine gap analysis by a comparison between expected and actual result. Describe in detail the ways to achieve the goal. 	Total: 10 hrs. Theory:2 hrs. Practical:8 hrs.	As unit-1	Class Room/Lab

Module: 0714001076 Develop 3D simulations

Objective of the Module: The objective of this exercise is to have the knowledge and understanding of 3D simulations. This includes managing 3D modeling tools, building and simulating 3D models, generating coordinating systems for 3D models, and testing generated G-Codes.

Duration:	Total hours	40 Hrs	Theory:	8 Hrs	Practical	32 Hrs
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Manage 3D modelling tools	The Trainee must be able to: <ul style="list-style-type: none"> List the available modelling 	<ul style="list-style-type: none"> Describe various modelling tools Demonstrate selection of modelling 	Total: 7 hrs. Theory:1 hr. Practical:6 hrs.	<ul style="list-style-type: none"> 3D modeling tools (e.g. AutoCAD, Google sketches) 	Class Room/Lab

	<p>tools</p> <p>The Trainee must be able to:</p> <ul style="list-style-type: none"> • Select the required/related modelling tools • Keep an up to date documentation of modelling tools with respect to compatibility • Upgrading and troubleshooting modelling tools 	<p>tool based on requirements</p> <ul style="list-style-type: none"> • Describe how to maintain documentation of modelling tool compatibility • Demonstrate how to upgrade modelling tools • Demonstrate how to troubleshoot modelling tools <p>Practical</p> <ul style="list-style-type: none"> • Given a set of modelling tools, prepare documentation to manage the tools, perform upgradation of the tools, perform troubleshooting 		<ul style="list-style-type: none"> • 3D simulation tools (e.g. Proteus and other simulation software of robots) • Laptop (for running software) 	
LU2. Build models in 3D environment	<p>The Trainee must be able to:</p> <ul style="list-style-type: none"> • List the available simulation modes. • Select the required simulation mode. • Interpret the given design specifications • Formulate the procedure to design the 	<ul style="list-style-type: none"> • Describe various simulation modes • Demonstrate selection of simulation mode based on requirements • Describe how to interpret design specification • Describe the standard procedure for designing the model • Demonstrate designing 	<p>Total: 10 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:8 hrs.</p>	As unit-1	Class Room/Lab

	<p>model</p> <ul style="list-style-type: none"> • Design the model according to specifications • Cross-check design specifications with the built model 	<p>the model according to specification</p> <ul style="list-style-type: none"> • Demonstrate how to validate the model against the given specification. <p>Practical</p> <ul style="list-style-type: none"> • Given a design specification, prepare a 3D model according to specification and cross-check the specification with the built model 			
LU3. Simulate 3D models	<p>The Trainee must be able to:</p> <ul style="list-style-type: none"> • Prepare modelling tool for simulation. • Run basic simulation according to specifications • Generate basic G-codes • Prepare feasibility report 	<ul style="list-style-type: none"> • Describe how to use simulation mode in modelling tool • Demonstrate how to run simulation • Describe basics of G-code • Demonstrate how to generate G-codes • Describe how to prepare a feasibility report • Demonstrate preparation of feasibility report. <p>Practical</p> <ul style="list-style-type: none"> • Given a 3D model, run simulation on the model and generate G-codes. Also prepare a feasibility 	<p>Total: 10 hrs.</p> <p>Theory:2 hrs.</p> <p>Practical:8 hrs.</p>	As unit-1	Class Room/Lab

		report			
LU4. Convert / generate coordinating system for 3D model	<p>The Trainee must be able to:</p> <ul style="list-style-type: none"> • Generate system coordinates according to deployment requirements • Translate generated coordinates to physical workplace 	<ul style="list-style-type: none"> • Describe coordinate conversion process • Demonstrate how to generate systems coordinates based on requirements • Demonstrate how to translate generated coordinate to physical coordinates. <p>Practical</p> <ul style="list-style-type: none"> • Given a 3D Model, generate system coordinates and then translate them to physical workspace 	<p>Total: 7 hrs.</p> <p>Theory:1 hrs.</p> <p>Practical:6 hrs.</p>	As unit-1	Class Room/Lab
LU5. Test generated G-Code	<p>The Trainee must be able to:</p> <ul style="list-style-type: none"> • Set up working environment for sample testing • Acquire sample work piece • Perform practical implementation of the generated G-code • Prepare performance report 	<ul style="list-style-type: none"> • Describe how to setup working environment • Describe work piece requirements and selection process • Demonstrate how to process work piece using G-codes • Demonstrate how to prepare performance report. <p>Practical</p> <ul style="list-style-type: none"> • Given G-codes generated from a 3D model, implement 	<p>Total: 7 hrs.</p> <p>Theory:1 hr.</p> <p>Practical:6 hrs.</p>	As unit-1	Class Room/Lab

		the G-code on physical work piece and prepare performance report			
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Module: 0714001077 Assist engineers in design, configuration and application

Objective of the Module: This competency standard explains how to assist engineers in executing the design process, managing tools/equipment and perform equipment tests according to given plan. The learner will be able to understand the design process, management of tools and equipment and performing equipment tests according to manuals after completing this competency.

Duration:	Total hours	30	Theory:	6	Practical	24
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
CU1. Execute repetitive/manual design process	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Collect the design process instruction from an Engineer. Follow the instructions to execute the design process. Report problems occurred during the design process. 	<ul style="list-style-type: none"> Describe the types of engineering drawing. What are the basic components of engineering drawing? Why are engineering drawings important? How do you read engineering drawing? 	<p>Total: 10 hrs.</p> <p>Theory: 2 hrs.</p> <p>Practical: 8 hrs.</p>	<ul style="list-style-type: none"> Tool Kits (electrical and mechanical) Test bench Computers Printers Tools for system calibration 	Class Room/Lab

CU2.Manage tools and equipment	<ul style="list-style-type: none"> • Identify tools and equipment to be used. • Follow instructions to arrange and calibrate the tools and equipment. • Ensure availability of tools and equipment for a specified job. • Gather the tools and equipment after completion of the job. 	<ul style="list-style-type: none"> • What tools do you need to make a robot? • How do you start making a robot? • Which software is used in robotics? • What is instrument and instrumentation? • Why instrumentation is required? 	Total: 10 hrs. Theory:2 hrs. Practical:8 hrs.		Class Room/Lab
CU3. Execute test plan	<ul style="list-style-type: none"> • Prepare the test environment. • Arrange test tools and equipment. • Follow instruction to perform test. • Report the results of the executed test. 	<ul style="list-style-type: none"> • What is the purpose of testing an installation? • What is testing and inspection in electrical installation? • What is Robot testing? • What tools do you need to make a robot? 	Total: 10 hrs. Theory:2 hrs. Practical:8 hrs.		Class Room/Lab

General assessment guidance for Robotics Technician

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 Level, 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 **Robotics Technician** Lev-1-4 include:

- Work performances, for example installing or Assemble Robot with required safety precautions
- Demonstrations, for example demonstrating to Assemble the Robot for specific industry.
- Direct questioning, where the assessor would ask the student why he is considering the angle and why he is applying specific functional or nonfunctional test for the given robots
- Paper-based tests, such as multiple choice or short answer questions on health & safety, Communication skill, assemble robot or perform functional test or trouble shoot the require robot etc.

Indirect assessment is the method used where the performance could not be watched and evidence is gained indirectly.

Examples for indirect assessment of a **Robotics Technician** Lev-1-4 include:

- Work products, such as a Functioning robot in the specified industry or in the workplace or in the workshop.
- Completed trouble shoot report on any robotic functionality.
- Workplace documents, such as note book or practical activity journal

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 must meet all the following principles, regardless of the method of assessment used to evidence learners' attainment.

All assessments must produce outcomes that are:

- i. valid: the assessment evidence meets all assessment criteria and all learning outcomes
- ii. authentic: all the work is the learner's own
- iii. reliable: assessment evidence is consistent and generates outcomes that would be replicated were the assessment repeated
- iv. current: assessment evidence is up-to-date
- v. sufficient: enough work is available to justify the credit value, and to enable a consistent and reliable judgement about the learner's achievement
- vi. comparable: all assessment evidence is comparable in standard between assessments within a unit/qualification, and between learners of the same level
- vii. manageable: all assessment places reasonable demands on all learners
- viii. fair and minimize bias: assessments are fair to all learners irrespective of their characteristics (for example, age, gender, etc)

Assessment strategy for ROBOTICS TECHNICIAN Lev-1-4 Curriculum

This curriculum consists of 49 modules:

Module-1	Perform basic machining operations
Module-2	Operate the electronic measuring instruments
Module-3	Use measuring instruments for mechanics
Module-4	Obey the workplace policies and procedures
Module-5	Follow basic communication skills (general)
Module-6	Operate computer functions (general)
Module-7	Comply with work health and safety policies
Module-8	Manage routine tasks at workplace
Module-9	Maintain inventory at workplace
Module-10	Identify security arrangements for robotics equipment
Module-11	Operate robots at workplace
Module-12	Distinguish equipment / components for assembling purpose
Module-13	Do component testing for robotics
Module-14	Un-deploy robot at workplace
Module-15	De-commission robot at workplace
Module-16	Follow professional & technical knowledge about robotics
Module-17	Communicate the workplace policy and procedure
Module-18	Perform basic computer application (specific)
Module-19	Comply with personal health and safety guidelines
Module-20	Perform basic communication (specific)

Module-21	Perform functional testing of robotics
Module-22	Commission robot at workplace
Module-23	Deploy robot at workplace
Module-24	Monitor operations of robot at workplace
Module-25	Perform assembling of equipment / components
Module-26	Manage logistics at workplace
Module-27	Maintain product quality
Module-28	Apply professional & technical knowledge about robotics
Module-29	Identify and implement workplace policy and procedures
Module-30	Apply work health and safety practices (WHS)
Module-31	Manage personal finances
Module-32	Communicate at workplace
Module-33	Perform computer application skills
Module-34	Supervise juniors for transfer of knowledge
Module-35	Assure team productivity
Module-36	Perform maintenance of robotics
Module-37	Perform trouble shooting
Module-38	Revise the configuration of robotics
Module-39	Execute up-gradation of robotics
Module-40	Develop 3D simulations
Module-41	Assist engineers in design, configuration and application processes
Module-42	Ensure product quality

Module-43	Upgrade professional and technical knowledge about robotics
Module-44	Analysis workplace policy and procedures
Module-45	Contribute to work related health and safety (WHS) initiatives
Module-46	Perform advanced communication
Module-47	Develop advance computer application skills
Module-48	Manage human resource services
Module-49	Develop entrepreneurial skills

Sessional or Developmental assessment

The sessional/developmental assessment shall be conducted after completion of each module in two parts: theoretical assessment and practical assessment.

Theoretical assessment for all learning modules must consist of a written paper lasting at least 30 minutes 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 also be in two parts: theoretical assessment and practical assessment.

For the final practical assessment, each student shall be assessed over a period of 4-5 hours session. During this period, each student must be assessed on his ability to perform a complete job for all Technical and functional modules.

Generic modules shall be assessed comprising with other modules at the time of final assessment. Practical work for this module could be assessed on a sessional basis.

Planning of assessment.

Planning of assessment will plan by the assessment Centre as per CBT/A policy. But for development assessment it could be plan by the Trainer during the course.

As for final assessment as concern, certified assessor must be contacted and the assessor 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 20 students shall therefore require assessments to be carried out over a four-day period. For a group of only 10 students, assessments would be carried out over a two-day period only or it could be formulated as per CBT/A Centre policies.

Complete list of tools and equipment

S. No	Description	Quantity
1	Blower	As per Requirement
2	Chisel	As per Requirement
3	Drill bits	As per Requirement
4	Ellen key set	As per Requirement
5	Files	As per Requirement
6	Glasses (goggles)	As per Requirement
7	Gloves	As per Requirement
8	Grip plier	As per Requirement
9	Hacksaw	As per Requirement
10	Hammers	As per Requirement
11	Marking punch	As per Requirement
12	Measuring tape	As per Requirement
13	Micrometers	As per Requirement
14	Nose plier	As per Requirement
15	Open spanner set	As per Requirement
16	Phase tester	As per Requirement
17	Plier	As per Requirement
18	Ring spanner set	As per Requirement
19	Scissors	As per Requirement
20	Screw driver set	As per Requirement
21	Screw wrench	As per Requirement

		Requirement
22	Side cutter	As per Requirement
23	Crimping Tool	As per Requirement
24	Solder iron	As per Requirement
25	Spanner box	As per Requirement
26	Steel roll/Steel wire	As per Requirement
27	Sucker	As per Requirement
28	Silicone Gun	As per Requirement
29	Spirit Level	As per Requirement
30	Electric Drill Machine	As per Requirement
31	Hand Grinding Machine	As per Requirement
32	Thimble plier	As per Requirement
33	Tongs (sunny)	As per Requirement
34	Vernier caliper	As per Requirement
35	Wire gauge	As per Requirement
36	Wire stripper	As per Requirement
37	Adjustable Wrench	As per Requirement
38	Satellite Finder	As per Requirement
39	Multi-meter	As per Requirement
40	Digital Compass	As per Requirement
41	Wire Tester	As per Requirement
42	LAN Tester	As per Requirement
43	Rivet Gun	As per Requirement
44	Emergency lamp	As per Requirement

45	Coaxial Cable Stripper	As Requirement	per
46	Cable Compression Tool.	As Requirement	per
47	Air compressors.	As Requirement	per
48	Clamp meter.	As Requirement	per
49	Bench voice.	As Requirement	per
50	Drill machine.	As Requirement	per
51	Dryer.	As Requirement	per
52	Hand grinding machine	As Requirement	per

S. No.	Items
1.	Different Tags and Locks
2.	Process SOPs
3.	Equipment Maintenance Manuals
4.	Log Book
5.	Handbooks
6.	Design Books/ Sheets
7.	Pencils
8.	Erasers
9.	Pencil Sharpeners
10.	Paper Cutter
11.	Scissors
12.	Color Pencils
13.	White chart paper
14.	Brown Sheets
15.	White Board Markers (red, blue, green, black)
16.	Permanent markers (black)
17.	File covers

Credit values

The credit value of the National Certificate Level 1-4 in ROBOTICS TECHNICIAN 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 TVET guidelines).

The credit values are as follows:

Code	Name of Duty or (Module)	Category	Estimated Hours	Credit
000000000	Perform basic machining operations	Technical	50	05
000000000	Operate the electronic measuring instruments	Technical	50	05
000000000	Use measuring instruments for mechanics	Technical	50	05
000000000	Obey the workplace policies and procedures	Generic	20	02
000000000	Follow basic communication skills (general)	Generic	50	05
000000000	Operate computer functions (general)	Generic	50	05
000000000	Comply with work health and safety policies	Generic	30	03
000000000	Manage routine tasks at workplace	Functional	30	03
000000000	Maintain inventory at workplace	Functional	20	02
000000000	Identify security arrangements for robotics equipment	Technical	40	04
000000000	Operate robots at workplace	Technical	50	05
000000000	Distinguish equipment / components for assembling purpose	Technical	40	04
000000000	Do component testing for robotics	Technical	40	04
000000000	Un-deploy robot at workplace	Technical	40	04
000000000	De-commission robot at workplace	Technical	40	04
000000000	Follow professional & technical knowledge about robotics	Functional	20	02
000000000	Communicate the workplace policy and procedure	Generic	20	02
000000000	Perform basic computer application (specific)	Generic	40	04

000000000	Comply with personal health and safety guidelines	Generic	30	03
000000000	Perform basic communication (specific)	Generic	30	03
000000000	Perform functional testing of robotics	Technical	60	06
000000000	Commission robot at workplace	Technical	60	06
000000000	Deploy robot at workplace	Technical	60	06
000000000	Monitor operations of robot at workplace	Functional	40	04
000000000	Perform assembling of equipment / components	Technical	40	04
000000000	Manage logistics at workplace	Functional	40	04
000000000	Maintain product quality	Functional	20	02
000000000	Apply professional & technical knowledge about robotics	Functional	40	04
000000000	Identify and implement workplace policy and procedures	Generic	20	02
000000000	Apply work health and safety practices (WHS)	Generic	30	03
000000000	Manage personal finances	Generic	30	03
000000000	Communicate at workplace	Generic	30	03
000000000	Perform computer application skills	Generic	40	04
000000000	Supervise juniors for transfer of knowledge	Functional	30	03
000000000	Assure team productivity	Functional	30	03
000000000	Perform maintenance of robotics	Technical	50	05
000000000	Perform trouble shooting	Technical	60	06
000000000	Revise the configuration of robotics	Technical	50	05
000000000	Execute up-gradation of robotics	Technical	40	04
000000000	Develop 3D simulations	Technical	40	04
000000000	Assist engineers in design, configuration and application processes	Technical	40	04
000000000	Ensure product quality	Functional	30	03
000000000	Upgrade professional and technical knowledge about robotics	Functional	30	03
000000000	Analysis workplace policy and procedures	Generic	30	03
000000000	Contribute to work related health and safety	Generic	30	03

	(WHS) initiatives			
000000000	Perform advanced communication	Generic	30	03
000000000	Develop advance computer application skills	Generic	40	04
000000000	Manage human resource services	Generic	20	02
000000000	Develop entrepreneurial skills	Generic	30	03

