



Co-funded by the European Union



Norwegian Embassy
Islamabad



ROBOTICS TECHNICIAN



© TVET SSP

CBT Curriculum

National Vocational Certificate Level 1

Version 1 - October, 2019



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

URL links

Responsibility for the content of external websites linked in this publication always lies with their respective publishers. TVET Sector Support Programme expressly dissociates itself from such content.

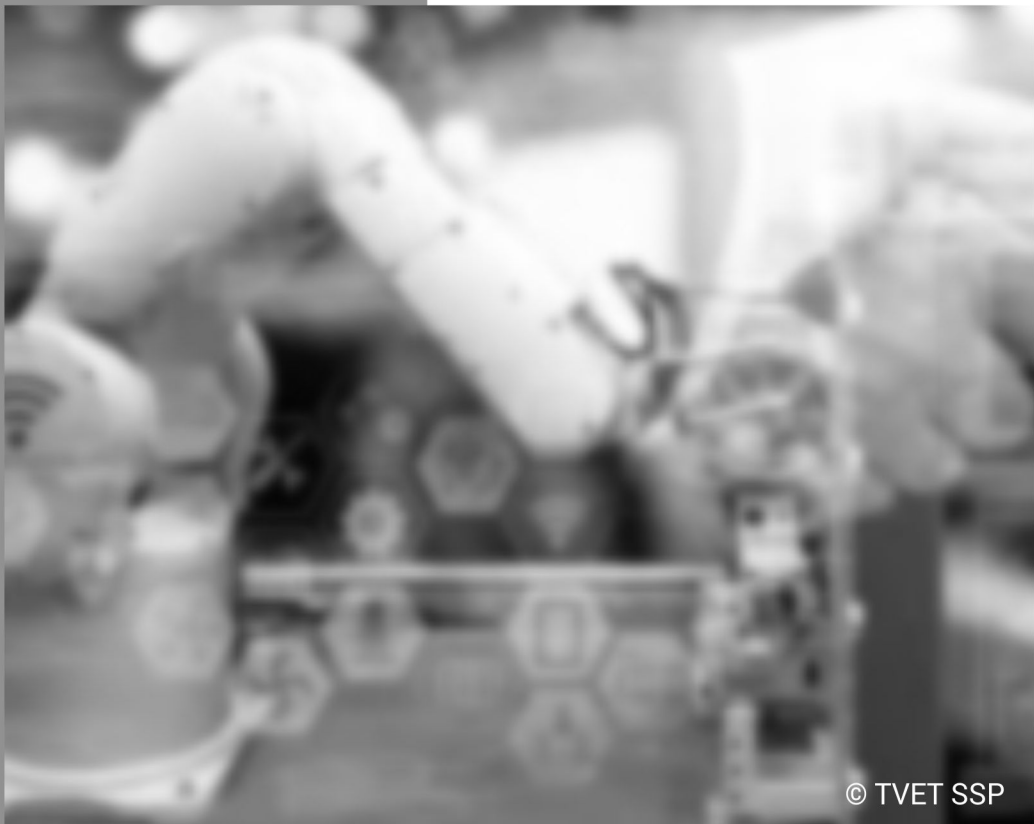
This document has been produced with the technical assistance of the TVET Sector Support Programme, which is funded by the European Union, the Federal Republic of Germany and the Royal Norwegian Embassy and has been commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in close collaboration with the National Vocational and Technical Training Commission (NAVTTTC) 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

October, 2019

Islamabad, Pakistan

ROBOTICS TECHNICIAN



CBT Curriculum
National Vocational Certificate Level 1

Version 1 - October, 2019

Introduction	5
Definition/ Description of the training program for Robotics Technician	5
Purpose of the training program	6
Overall objectives of training program	6
Competencies to be gained after completion of course	6
Possible available job opportunities available immediately and later in the future	7
Trainee entry level	7
Minimum qualification for trainer	7
Recommended trainer: trainee ratio	7
Medium of instruction i.e. language of instruction	8
Duration of the course (Total time, Theory & Practical time)	8
Sequence of the modules	9
Summary – overview of the curriculum	10
Modules	12
Module: 0714001050 Perform basic machining operations	12
Module: 0714001051 Operate the electronic measuring instruments	16
Module: 0714001052 Use measuring instruments for mechanics	21
General assessment guidance for Robotics Technician	25
Complete list of tools and equipment	31
Credit values	34

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 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:

PACKAGING OF QUALIFICATIONS

The national vocational qualifications are packaged as per following:

<p>National Vocational Certificate Level-1 0714 E&A 020 Robotics Technician (Helper)</p>	<ul style="list-style-type: none">• Perform basic machining operations• Operate the electronic measuring instruments• Use measuring instruments for mechanics• Obey the workplace policies and procedures• Follow basic communication skills (general)• Operate computer functions (general)• Comply with Work Health and Safety Policies
----------------------------------------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

- 3 Use measuring instruments for mechanics
- 4 Obey the workplace policies and procedures
- 5 Follow basic communication skills (general)
- 6 Operate computer functions (general)
- 7 Comply with work health and safety policies

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
Perform basic machining operations	10	40	50
Operate the electronic measuring instruments	20	30	50
Use measuring instruments for mechanics	14	36	50
Obey the workplace policies and procedures			20
Follow basic communication skills (general)			50
Operate computer functions (general)			50
Comply with work health and safety policies			30

Sequence of the modules

This qualification is made up of 7 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	Perform basic machining operations	1	05	Technical
2	Operate the electronic measuring instruments	1	05	Technical
3	Use measuring instruments for mechanics	1	05	Technical
4	Obey the workplace policies and procedures	1	02	Generic
5	Follow basic communication skills (general)	1	05	Generic
6	Operate computer functions (general)	1	05	Generic
7	Comply with work health and safety policies	1	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 basic machining operations	LU1 Interpret Assembly Drawings LU2 Perform Bench Work on Metallic Surfaces LU3 Prepare Lathe Machine for Different Operations LU4 Prepare Materials for Welding	10	40	50
Operate the Electronic Measuring Instruments	LU1 Evaluate the measuring instrument LU2 Operate Electrical Analogue measuring instruments LU3 Operate digital measuring instruments LU4 Familiarize with basics of oscilloscope and function generator	20	30	50
Use measuring instruments for mechanics	LU1 Take measurements with graduated tools LU2 Take measurements with combination set LU3 Take	14	36	50

	measurements through various gauges LU4 Perform measurements through Micro meter LU5 Perform different measurements			
--	---------------------------------------------------------------------------------------------------------------------------	--	--	--

Modules

Module: 0714001050 Perform basic machining operations

Objective of the Module: This competency standard is designed to gain basic knowledge and skills required to read and interpret assembly drawings, perform bench work operations using different tools and equipment, perform lathe machine operations and prepare materials for a welding job in accordance with the organization's approved guidelines and procedures.

Duration :	Total hours	50 Hrs	Theory :	10 Hrs	Practical	40 Hrs
------------	-------------	--------	----------	--------	-----------	--------

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1: Interpret Assembly Drawings	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Recognize basics of lines used in engineering drawings Understand different types of lines in engineering drawings Understand types of drawing views Identify assembly requirements according to drawings 	<ul style="list-style-type: none"> Demonstrate the lines on physical drawing sheets describe types of lines use in engineering drawings describe the lines thickness qualities demonstrate pencil types to draw the engineering drawing lines develop the insight to see the different views of an engineering parts demonstrate the engineering views on actual drawing sheets demonstrate the 	<p>Total: 13 hrs. Theory: 3 hrs. Practical: 10 hrs.</p>	<ul style="list-style-type: none"> Sample drawing sheets or Sketches Layout tools Measuring devices (screw gauge, Vernier calliper) Handheld calculator Hacksaw Special robot tool kit P.P.E Drill set Drill machine Grinder Hacksaw Drill set Drill machine Grinder Turret lathe 	Class Room/ Lab

		<p>assembly points mention in an industrial drawing</p> <ul style="list-style-type: none"> • demonstrate the signs using in assembly drawings • demonstrate the assembly drawing sheet and its building on any commercial software 		<p>machine</p> <ul style="list-style-type: none"> • Tool grinder • Lathe cutting tools • Multi- process • welding equipment • Base metals • Welding machine • Engine lathe machine • Personal safety kits • Hardware complete tool kit 	
		<p>Praticle-1</p> <ul style="list-style-type: none"> • Draw the free hand sketches of assembly parts on sketch books • draw the different assembly lines on drawing sheet • draw the free hand sketches of drawing views • explain the drawing sheets using in real time industrial assembly lines 			
<p>LU2: Perform Bench Work on Metallic Surfaces</p>	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Carry-Out Sawing • File the Work-Piece • Carry out Drilling Process • Produce 	<ul style="list-style-type: none"> • Describe the types of foils and their usage • describe the using of bench voices • Describe the threads types • demonstrate the types of 	<p>Total: 12 hrs. Theory: 2 hrs. Practical: 10 hrs.</p>		<p>Class Room/ Lab</p>

	<p>Threads on Work-Piece</p> <ul style="list-style-type: none"> • Perform Hand Reaming 	<p>tap die for making threads on work piece</p> <ul style="list-style-type: none"> • Describe the drilling & reaming process • Demonstrate the drilling & reaming tools on industrial grounds <p>Practicle-1</p> <ul style="list-style-type: none"> • make the work piece using foils and tap dies using bench voices • perform the drilling operations on work piece using bench voices • develop the work piece/die using the reaming tools 			
<p>LU3. Prepare Lathe Machine for Different Operations</p>	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Prepare Materials for Lathe Operations • Select Tools and Equipment • Set Lathe Machine for Operations 	<ul style="list-style-type: none"> • Describe the lathe machine parts • Describe the lathe machine operations • Demonstrate the lathe machine tools used for different operations <p>Practicle-1</p> <ul style="list-style-type: none"> • develop the different work pieces using lathe machine operations • develop the machine 	<p>Total: 13 hrs. Theory: 3 hrs. Practical: 10 hrs.</p>		<p>Class Room/ Lab</p>

		parts used in an assembly line		
LU4. Prepare Materials for Welding	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Select and Mark Material/s as per Drawing/Job Requirement • Cut and Prepare Edge/s of Base Materials • Knowledge of welding equipment • Fit-up Base Materials • Knowledge of materials 	<ul style="list-style-type: none"> • Describe the welding and its types • Demonstrate the welding processes • describe the welding rods and their usage conditions • describe the codes written on welding rods and their suitability with different welding conditions • demonstrate the welded joints • describe the needs of particular type of welding in a specified condition <p>Practice-1</p> <ul style="list-style-type: none"> • Perform the welding operations to join the real time industrial broken parts used in an assembly line/robotic production line. <p>Practice-2</p> <p>Select, arrange and prepare tools and equipment for ARC welding.</p> <p>Practice-3</p> <p>Select, arrange and prepare tools and equipment for GAS welding.</p>	<p>Total: 12 hrs. Theory: 2 hrs. Practical: 10 hrs.</p>	Class Room/ Lab

Module: 0714001051 Operate the electronic measuring instruments

Objective of the Module:

The purpose of this competency standard is to become familiar with different types of electrical and electronic measuring instruments. After completion of this competency standard the candidate will be skilled in taking measurement from different types of electrical and electronic measuring instruments.

Duration:	Total hours	50	Theory:	20	Practical	30
-----------	-------------	----	---------	----	-----------	----

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1. Evaluate the measuring instrument	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Classify the instrument type (analogue/digital). Check the type of power source needed. Evaluate and assemble the device and probes with proper procedure (as per manual). Perform zero error tests as described in the procedure. Identify the measuring units/parameters of the device as per SOP. 	<ul style="list-style-type: none"> Demonstrate evaluation procedure Explain Basic instruments and its types. Explain and demonstrate Analog instruments. Explain and demonstrate Digital instruments. Explain and demonstrate operation of analogue measuring instruments AC and DC instruments Direct method measuring instruments Comparison method measuring instruments Indicating instruments Electromechanical instruments Electronic instruments Recording instruments Integrating 	<p>Total: 20 hrs. Theory: 8 hrs. Practical: 12 hrs.</p>	<ul style="list-style-type: none"> Electrical test bench Multi-meter Test probes Hand glove Analogy meter DMM Thermometer 2-channel AC/DC Power supply 5V, 12V, 24V Oscilloscope Breadboard trainer Power source (AC/DC) Digital multi meter Lux meter Power meter Power factor meter, Frequency meter Energy meter etc. 	Class Room/ Lab

	<ul style="list-style-type: none"> • Set the readability of the instrument with respect to range. • Record the findings and develop the report. 	<ul style="list-style-type: none"> instruments • Explain and demonstrate operation of digital measuring instruments • Explain and demonstrate DC power sources • Explain and demonstrate Ac power Sources • understanding of manual and diagrams for assembling the device. • explain zero error • perform zero error test on device. • basic measuring parameter with their units (voltage current resistance capacitance inductance and frequency) • operation of multi range meter. • selection of range with respect to desired parameter. • procedure for recording as per manual of equipment • procedure for reporting <p>Practical: Perform Zero error test.</p>	<ul style="list-style-type: none"> • Electrical test bench • Digital Multi-meter • Digital Power source (AC/DC) • Manual tools • Screw drivers • Tweezers Tool • Wire Cutter • Nose plier • Soldering iron • Sucker • Electrical test bench • Power source (AC/DC) • Oscilloscope • Function generator • IC/components • Gold Aluminum Housed Wire wound Resistor-AH-50W-1k 	
LU2.Operate Electrical Analogue measuring instruments	The trainee must be able to: <ul style="list-style-type: none"> • Determine the type of 	<ul style="list-style-type: none"> • Explain overview of measuring parameter 	<p>Total: 10 hrs. Theory: 4 hrs. Practical: 6</p>	Class Room/ Lab

	<p>electrical/electronic parameter to be measured.</p> <ul style="list-style-type: none"> • Select the relevant measuring instrument as per parameter to be measured. • Test point identification for measurement. • Connect the instrument according to the prescribed method. • Follow the procedure for reading value on the display 	<ul style="list-style-type: none"> • Explain selection procedure of measuring parameter • Explain selection procedure of measuring instrument • Explain procedure for identification of test point • Explain and demonstrate selection of test point • Explain methods of measurement (i.e. voltage current). • Demonstrate connection procedure for measurement • Demonstrate procedure to extract value according to the selected range. • Demonstrate tools required for measurement <p>Practical-1: Find resistance of standard resistor (AH-50w-1k) through analogue multi meter.</p> <p>Practical-2: Generate 10volt using variable power supply and then measure it using analogue multi meter</p> <p>Practical-3: Apply 10v to standard</p>	<p>hrs.</p>		
--	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------	--	--

		resistor (AH-50w-1k) and find the current using analogue multi meter			
LU3.Operate digital measuring instruments	The trainee must be able to: <ul style="list-style-type: none"> Identify the type of quantity to be measured. Select the relevant measuring instrument as per parameter to be measured. Test point identification for measurement. Connect the instrument according to the prescribed method. Follow the procedure for reading value on the display 	<ul style="list-style-type: none"> Explain overview of measuring parameter Explain selection procedure of measuring parameter Explain selection procedure of measuring instrument Explain and demonstrate procedure for identification of test point Demonstrate selection of test point Demonstrate methods of measurement (i.e voltage current). Demonstrate connection procedure for measurement Demonstrate procedure to extract value according to the selected range. <p>Practical-1: Find resistance of standard resistor (AH-50w-1k) through digital multi meter.</p> <p>Practical-2: Generate 10volt using variable power supply and then measure it</p>	Total: 10 hrs. Theory: 4 hrs. Practical: 6 hrs.	As Unit-1	Class Room/ Lab

		<p>using digital multi meter</p> <p>Practical-3: Apply 10v to standard resistor (AH-50w-1k) and find the current using digital multi meter</p>			
<p>LU4. Familiarize with basics of oscilloscope and function generator</p>	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> Identify components and control knobs of oscilloscope . Familiarize with operating panel and display control. Adjust screen resolution and calibrate screen with probes. Measure the AC/DC signal on oscilloscope using function generator. 	<ul style="list-style-type: none"> Explain Basic functionality of oscilloscope and function generator. demonstrate screen, control panel and probes demonstrate working of each knob/button explain and demonstrate how to extract reading of the signal demonstrate procedure of calibration of the oscilloscope Demonstrate procedure for the adjustment of screen resolution Demonstrate procedure to generate AC signal from function generator Demonstrate procedure to generate DC signal from function generator Demonstrate procedure for connection (oscilloscope with function generator) 	<p>Total: 10 hrs. Theory: 4 hrs. Practical: 6 hrs.</p>	As Unit-1	<p>Class Room/ Lab</p>

		<ul style="list-style-type: none"> Demonstrate procedure for measurement of signal using oscilloscope. <p>Practical-1: Generate 5v RMS 50hz signal using function generator and measure peak voltage, peak to peak voltage, RMS voltage, time period and frequency of that signal using oscilloscope</p>			
--	--	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--	--	--

Module: 0714001052 Use measuring instruments for mechanics

Objective of the Module:

This competency standard covers the skills and knowledge required to take measurements with Steel rule, Hook rule, Folding rule, Trammels, combination set, micrometre, Vernier calliper, various gauges and different measurement instruments.

Duration:	Total hours	50 Hrs	Theory:	14 Hrs	Practical	36 Hrs
-----------	-------------	--------	---------	--------	-----------	--------

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials (Tools & Equipment) Required	Learning Place
LU1.Take measurements with graduated tools	The trainee must be able to: <ul style="list-style-type: none"> Take measurements using a Steel rule Take measurements using a Hook rule Take measurements using a Folding 	<ul style="list-style-type: none"> Describe units of different measuring parameters. describe the measuring techniques using different measuring equipment's Describe how to develop the own measuring tools under different circumstances demonstrate the levelling of measuring rules to get the 	Total: 7 hrs. Theory: 1 hr. Practical: 6 hrs.	<ul style="list-style-type: none"> Steel rule Work piece Surface plate Steps and collars Hook rule Folding rule Trammel Combination set 	Class Room/ Lab

	<p>rule</p> <ul style="list-style-type: none"> • Take measurements with Trammels 	<p>appropriate readings</p>			
		<p>Practicle-1</p> <ul style="list-style-type: none"> • measure the different lengths using different types of measuring rule(s) 			
<p>LU2.Take measurements with combination set</p>	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Take Measurement with Square head • Perform levelling with square head as spirit level • Measure depth with square head as depth gauge • Measure height with square head as height gauge 	<ul style="list-style-type: none"> • Explain the types of measuring heads • demonstrate the method to take the appropriate readings from different types of measuring heads <p>Practical-1</p> <ul style="list-style-type: none"> • measure the depths of industrial parts using measuring heads manufactured by industrial robot • measure the heights for industrial parts manufactured by robot using measuring gauges 	<p>Total: 7 hrs. Theory: 1 hr. Practical: 6 hrs.</p>	<ul style="list-style-type: none"> • Screw thread Micro meter • Vernier Calliper • Height Gauge • Vernier calliper • Dial thickness gauge • Dial indicator 	<p>Class Room/ Lab</p>

LU3.Take measurements through various gauges	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Take measurement with fixed gauge and plug gauge. • Take measurement with adjustable gauge • Take measurement with small hole gauge • Take measurement with telescope gauge 	<ul style="list-style-type: none"> • Explain different types of measuring gauges used under different operating conditions • illustrate the different measuring techniques using measuring gauges • demonstrate how measuring gauges are used while developing the robotic based environment <p>Practical-1</p> <ul style="list-style-type: none"> • Measure the heights of assembly line parts using measuring gauges 	<p>Total: 9 hrs. Theory: 2 hr. Practical: 7 hrs.</p>	<ul style="list-style-type: none"> • Coordinate measuring machines <ul style="list-style-type: none"> • ISO tables of fits and tolerance • Measurement tools 	<p>Class Room/ Lab</p>
LU4.Perform measurements through Micro meter	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Take measurement with outside micro-meter • Take measurement with inside micro meter • Take measurement with depth micro meter • Measure threads with micro 	<ul style="list-style-type: none"> • Explain working of micro meter • demonstrate the micro meter usage under real time conditions • Explain types of threads measurements using micro meter. • demonstrate the threads measurements using micro meter <p>Practical-1</p> <ul style="list-style-type: none"> • measure the heights of different parts using micro meter while working on lathe machine • measure the necessary heights/lengths/diameters manufactured 	<p>Total: 9 hrs. Theory: 2 hr. Practical: 7 hrs.</p>	<ul style="list-style-type: none"> • Surface plate • Scriber • Tri square • Divider • Round stock • Fix gauge • Telescope 	<p>Class Room/ Lab</p>

	<p>meter</p> <ul style="list-style-type: none"> • Take measurement with Vernier micro meter 	<p>under robotic environment using micro meters</p>			
LU5. Measure dimensions with Vernier tools	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Take measurement with Vernier calliper • Take measurement with height gauge • Take measurement with Vernier depth gauge 	<ul style="list-style-type: none"> • Explain working of Vernier tools • demonstrate the Vernier tool usage under real time conditions • describe the types of measurements using Vernier tool <p>Practical-1</p> <ul style="list-style-type: none"> • measure the heights of different parts using Vernier tool while working on lathe machine • measure the necessary heights/lengths/diameters manufactured under robotic environment using Vernier tool 	<p>Total: 9 hrs. Theory: 2 hr. Practical: 7 hrs.</p>	<ul style="list-style-type: none"> • Surface plate • Radius gauge • Ring Gauge • Plug Gauge • Angle gauge • Adjustable gauge 	Class Room/ Lab
LU6. Perform different measurements	<p>The trainee must be able to:</p> <ul style="list-style-type: none"> • Take measurement with dial calliper • Take measurement with dial thickness gauge • Take measurement with dial 	<ul style="list-style-type: none"> • Describe the measurements techniques • Describe the types of tolerances & allowances in measurements techniques • Describe the tool maker microscope • Describe and demonstrate the robotic based measurement techniques • Demonstrate the measurements techniques and tools 	<p>Total: 9 hrs. Theory: 2 hr. Practical: 7 hrs.</p>	<ul style="list-style-type: none"> • Surface gauge • Dial indicator • Outside Micrometer • Inside Micrometer • Depth Micrometer • Gauge blocks • Tool makers microscope 	Class Room/ Lab

	<p>Indicator</p> <ul style="list-style-type: none"> • Exercise on gauge blocks • Exercise on tool makers microscope • Practice on Profile Projector • Practice Of Digital Instruments • Measure tolerance and allowances 	<p>Practical-1</p> <ul style="list-style-type: none"> • Measure the robotic based assembled parts using dial calliper/dial thickness gauge/dial indicators/gauge blocks/profile projectors/digital instruments • measure the tolerances & allowances using measuring gauges for robotic based assembled parts 			
--	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--	--	--

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	Allen 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

