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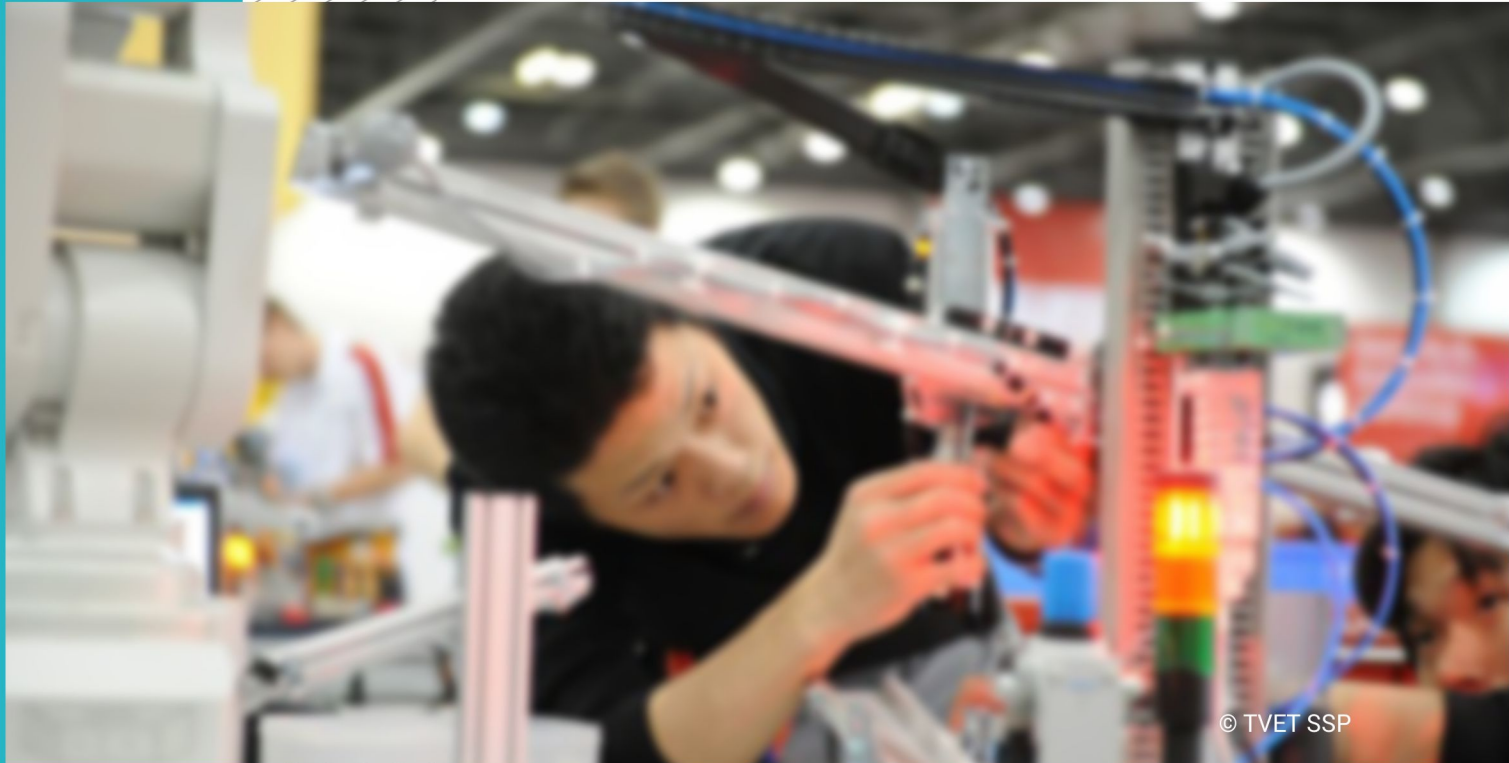
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CBT CURRICULUM

National Vocational Certificate Level 3

Version 1 - July, 2019



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Introduction

Definition/ Description of the training programme for *Industrial Automation, Level-3*

Industrial Automation is a technology in which a process or procedure is accomplished by means of programmed instructions usually combined with automatic feedback control to ensure the proper execution of the instructions to achieve a specific goal. A program of instructions determines the actions performed by an automated system. The program operates the system without human intervention, although the automated process or procedure may involve human interaction (e.g., an automated teller machine). Automation can be used in a wide variety of application areas like in manufacturing, Spot-welding, Arc welding, Tube bending, sheet metal pressing and forming, in process industry (chemicals, fertilizers, refineries, painting), power industry, remote sensing and control applications.

Industrial Automation can advantage in following aspects:

- **Increase in productivity.**

Automation of an operation usually increases production rate and output per labor hour.

- **Reduction of labor cost.**

As labor cost increases, economics tends to force a substitution of automated equipment for labor. Because production rate is usually increased and labor cost is reduced by use of automated equipment, the unit cost of product is reduced.

- **Labor shortages**

In many industrialized nations, there is a labor shortage, forcing these countries to increase production by seeking alternatives to the use of labor. Automation is such an alternative.

- **Safety**

Automation of a production operation tends to remove the human from direct participation in the operation. This improves safety in potentially dangerous production situations. The Occupational Safety and Health Agency has motivated the automation of unsafe jobs.

- **High cost of materials**

Higher levels of efficiency in processing of raw materials require tighter controls in manufacturing, which can often be achieved through automation.

- **Improved quality**

Automated production usually achieves greater consistency in processing. Consistency is one measure of product quality. Automobile companies have achieved significant gains in product quality through the automation of certain critical assembly processes such as robotic spot welding of car bodies.

- **Reduction of manufacturing lead-time**

Manufacturing lead-time is the time between customer order and delivery of the finished product. Automation usually means less time to produce the product, leading to greater customer satisfaction and a competitive advantage in manufacturing.

- **Increase in flexibility**

The increase of flexibility is one of growing concern to manufacturers; flexibility to change quickly over from one product to another and flexibility to accommodate new products. With programmable automation, these flexibilities can be achieved.

Purpose of the training programme

The purpose of the Industrial Automation course is train young people to cater the demand of this growing field. In few coming years all the conventional industry will be shifted to Automated Control based industry.

Overall objectives of training programme

The overall objectives of the Industrial Automation program are producing Industrial Automation skilled staff to:

- Target & support operation and maintenance of automated Industrial Units
- Providing services as support vendors in the field of industrial controls
- Attract new technology and meet export quality criteria
- Uplift the industrial environment, quality and quantity of production
- Work hygienically and Safely

Competencies to be gained after completion of course

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

Perform Basic Computer Operations

Perform Programmable Logic Controller Operations (PLC)

Develop Human Machine Interface (HMI)

Apply Work Health and Safety Practices (WHS)

Identify and Implement Workplace Policy and Procedures

Communicate at Workplace

Perform Computer Application Skills

Manage Personal Finances

Possible available job opportunities available immediately and later in the future

Industrial Automation technicians can be employed in all type of industrial set ups like manufacturing, process, chemicals, services & energy etc.

Trainee entry level

Middle with Level -2

Minimum qualification of trainer

Industrial Automation CBT Level-IV Qualified with 02 Years Industry relevant experiences /DAE Qualified with 03 Years Industry relevant experiences/BSc/B.Tech, Qualified with 01 Years Industry relevant experiences .

Recommended trainer: trainee ratio

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

Medium of instruction i.e. language of instruction

Instruction will be Urdu and English.

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

This curriculum comprises 7 modules. The recommended delivery time is 680 hours. Delivery of the course could therefore be full time, 6 days a week, for 06 months. Training providers are at liberty to develop other models of delivery, including part-time and evening delivery.

The full structure of the course is as follow:

Module	Theory ¹ Days/hours	Workplace ² Days/hours	Total hours
Module 1: Perform Programmable Logic Controller Operations(PLC)	84	336	420
Module 2: Develop Human Machine Interface (HMI)	22	88	110
Module 3: Apply Work Health and Safety Practices (WHS)	00	00	30
Module 4: Identify and Implement Workplace Policy and Procedures	00	00	20
Module 5: Communicate at Workplace	00	00	30
Module 6: Perform Computer Application Skills	00	00	40
Module 7: Manage Personal Finances	00	00	30

¹ Learning Module hours in training provider premises

² Training workshop, laboratory and on-the-job workplace

Sequence of the Modules:

This qualification is made up of 7 modules. Two modules are related to prerequisites to Industrial Controls & Industrial Automation & its specific applications. These modules are 1 & 2. The remaining are generic modules. However their contents are supportive to Industrial Control & Automation environments.

Modules 3, 4, 6 & 7 are related to Occupational Health, Safety, and Computer applications, Workplace Policy and Procedures and Finances.

Another module i.e.5 is related to the Communication skills needed at work places.

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

The distribution table is shown below:

Module 1: Perform Programmable Logic Controller (PLC) Operations 420 Hours	Module 3: Apply Work Health and Safety Practices (WHS) 30 Hours	Module 5: Communicate at Workplace 30 Hours
	Module 4: Identify and Implement Workplace Policy and Procedures 20 Hours	Module 2: Develop Human Machine Interface (HMI) 110 Hours
Module 6: Perform Computer Application Skills 40 Hours	Module 7: Manage Personal Finances 30 Hours	

Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
<p>Module 1: Perform Programmable Logic Controller (PLC) Operations</p> <p>Aim: The aim of this module to get knowledge, skills and understanding to perform programmable logic controller (PLC) operations</p>	<p>LU1: Integrate Programmable Logic Controller</p> <p>LU2: Develop logic for Programmable Logic Controller</p>	84	336	420
<p>Module 2: Develop Human Machine Interface (HMI)</p> <p>Aim: The aim of this module to get knowledge, skills and understanding to develop human machine interface (HMI)</p>	<p>LU1: Configure HMI</p> <p>LU2: Develop graphical User Interface</p> <p>LU3: Develop HMI Programs & Recipes</p>	22	88	110
<p>Module 3: Apply Work Health and Safety P Hours ractices (WHS)</p> <p>Aim:</p>	<p>LU1: Implement safe work practices at work place</p> <p>LU2: Participate in hazard assessment activities a work place</p> <p>LU3: Follow emergency procedures at workplace</p> <p>LU4: Participate in OHS consultative processes</p>	00	00	30
<p>Module 4: Identify and Implement Workplace Policy and Procedures</p> <p>Aim:</p>	<p>LU1: Identify workplace policy & procedures</p> <p>LU2: Implement workplace policy & procedures</p> <p>LU3: Communicate workplace policy & procedures</p> <p>LU4: Review the implementation of workplace policy & procedures</p>	00	00	20

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 5: Communicate at Workplace Aim:	LU1: Communicate within the organization LU2: Communicate outside the organization LU3: Communicate effectively in workgroup LU4: Communicate effectively in workgroup	00	00	30
Module 6: Perform Computer Application Skills Aim:	LU1: Prepare In-page documents as per required information LU2: Prepare Spreadsheets as per required information LU3: Use MS Office as per required information LU4: Perform computer graphics in basic applications LU5: Create Email account for communications	00	00	40
Module 7: Manage Personal Finances Aim:	LU1: Develop a personal budget LU2: Develop long term personal budget LU3: Identify ways to maximize future finances	00	00	30

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Module-1

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Modules

Module 1: 071400938 Perform Programmable Logic Controller (PLC) Operations

Objective of the module: The aim of this module to get knowledge, skills and understanding to perform programmable logic controller (PLC) operations

Duration: 420 hours **Theory:** 84 hours **Practical:** 336 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Integrate Programmable Logic Controller	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Select tools and hardware as per requirement 2. Attach modules with PLC as per requirement 3. Install wiring of PLC with digital instruments 4. Install wiring of PLC with analogue instruments 5. Integrate pneumatic and hydraulic instruments with PLC as per requirement 	<p>Study of various tools to be used for PLC-based exercises; comparison between PLC and tradition controllers; Main parts of PLC and their function; Study different types of PLC w.r.t switching.</p> <p>Explain the integration of discrete I/O module of PLC; analog I/O module of PLC.</p> <p>Identification of physical I/O modules of PLC and their addressing.</p> <p>Knowledge of sourcing/sinking wiring of PLC.</p> <p>Study the pin configuration of PLC and extra digital I/Os modules.</p> <p>Study the pin configuration of analogue module; differentiate between power signal and control signal.</p> <p>Understand the integration of pneumatic instruments and hydraulic instrument with PLC.</p>	<p>Total 45 hrs</p> <p>Theory: 15 hrs</p> <p>Practical: 30 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Thimbles • Tags • Control wires • Instrument Air • Hydraulic Oil <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet • PLC Hardware and accessories 	Class room / Lab / Workshop

				<ul style="list-style-type: none">• Communication Cables• Cables wires and attachments• Digital Input and Output Devices• Analog Input and output Devices• Hydraulic Equipment and accessories• Pneumatic Equipment and accessories• Circuit Breakers• Power Supply• Ducting• Digital modules• Analog modules• PLC Trainer• Hydraulic	
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				Trainer <ul style="list-style-type: none"> • Pneumatic Trainer • External timer and counters 	
LU2: Develop logic for Programmable Logic Controller	The trainee will be able to: <ol style="list-style-type: none"> 1. Select software as per requirement 2. Program digital control operations via simulation as per application 3. Program digital control operations with hardware as per application 4. Program analogue control operations via simulation as per application 5. Program analogue control operations with hardware as per application 	<p>Understanding of software such as</p> <ul style="list-style-type: none"> • Identification of different software used for PLC programming; • Installation of programming software. • Study the basic operational & functional keys of software. • Study data sheet of Built-in/software based relay Instructions • Study data sheet of Built-in/software based data registers. • Study of different communication protocols of PLC. <p>Understanding the simulation methods in PLCs.</p> <p>Study PLC programming for digital operations using hardware.</p> <ul style="list-style-type: none"> • Communication between PC and PLC. • Switching Instructions. • Arithmetic Instructions. • Data processing instructions. • Timing and counting instructions. • Special instructions. • Subroutine instructions. <p>Study PLC programming for analogue</p>	Total 375 hrs Theory: 69 hrs Practical: 306 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Hydraulic Oil • Instrument Air Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet • PLC Software • Digital Devices • Analog Devices • Hydraulic Trainer • Pneumatic Trainer 	Class room / Lab / Workshop

		<p>operations using hardware.</p> <ul style="list-style-type: none"> • Identification of analogue signals encountered with PLC. • Analogue configuration through software. • Analogue signal processing. • Thermocouple module and signal processing • PT module and signal processing. • Load cell module and signal processing. • PID Instruction and operation. • Pressure handling analogue devices. 		<ul style="list-style-type: none"> • Power Supply • PC • Communication Cables and accessories 	
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Module-2

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Module 2: 071400939 Develop Human Machine Interface (HMI)

Objective of the module: The aim of this module to get knowledge, skills and understanding to develop human machine interface (HMI)

Duration: 110 hours **Theory:** 22 hours **Practical:** 88 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Configure HMI	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> Select HMI hardware, software and communication cables as per requirement Establish communication of HMI with other controllers 	<p>Understand the concept of HMI systems</p> <p>Understanding of different HMI systems.</p> <p>Describe the various communication protocols (e.g. Modbus, TCP/IP, Profibus, Profinet) used for HMI</p> <p>Understanding the implementation process of an HMI communication with different controllers (e.g. PLCs, VFDs, Servo Drive, Actuators and Analyzers)</p>	<p>Total</p> <p>21 hrs</p> <p>Theory:</p> <p>06 hrs</p> <p>Practical:</p> <p>15 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Batteries/cell for power backup <p>Non Consumable</p> <ul style="list-style-type: none"> White board Multimedia Computer system with internet HMI trainer HMI software application Communication cables PLC-HMI 	Class room / Lab / Workshop

				Interface cables • Memory cards for backup	
LU2: LU2: Develop graphical User Interface	The trainee will be able to: 1. Design process diagram as per requirement 2. Configure tags as per requirement 3. Simulate GUI as per requirement 4. Integrate GUI with controller as per requirement	Understand the process flow diagrams (PFDs) and process and instrumentation diagrams (P&IDs) of the given processes Understand the basic operations of software used for HMI designing Implementation of some basic examples of an HMI such as: <ul style="list-style-type: none"> • Level Determination • Traffic Light Signal • Ampere Meter Understand basic simulation techniques for HMI development Static screen development: depicting the complete plant in different screens Dynamic linking of tags: Communications with the PLC and animation of graphic objects according to the status of the process. Trending: viewing the X-Y plots of different parameters for analysis	Total 65 hrs Theory: 10 hrs Practical: 55hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet • HMI trainer • HMI software application • Communication cables • PLC-HMI Interface cables 	Class room / Lab / Workshop
LU3: Develop HMI Programs & Recipes	The trainee will be able to: 1. Create recipes in	Configuring Alarms, recipes and report	Total 24 hrs	Consumable <ul style="list-style-type: none"> • Notebooks 	Class room / Lab / Workshop

	<p>HMI as per requirement</p> <p>2. Create alarms in HMI as per requirement</p> <p>3. Create macros in HMI as per requirement</p> <p>4. Set security levels in HMI</p>	<p>generation.</p> <p>Implementation of back screen macros in HMI</p> <p>Securities: setting up authentications and access controls while adhering to organizational practices.</p> <p>Test and Troubleshoot the developed HMI system.</p>	<p>Theory: 06hrs</p> <p>Practical: 18 hrs</p>	<ul style="list-style-type: none"> • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet • HMI trainer • HMI software application • Communication cables • PLC-HMI Interface cables application 	
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Module-3

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Module 3: Apply Work Health and Safety Practices (WHS)

Objective of the module: The aim of this module to get knowledge, skills and understanding to ensure health, hygiene and safety of other individuals at work

Duration: 30 hours **Theory:** 00 hours **Practical:** 00 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Implement safe work practices at work place	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Implement relevant rules and procedures of WHS at work place. 2. Comply with duty of care requirements 3. Use personal protective equipment according to safe work practices 4. Contribute to WHS consultative activities 5. Raise WHS issues with relevant personnel 		<p>Total</p> <p>Theory:</p> <p>Practical:</p>	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	
LU2: Participate in hazard	The trainee will be able		Total	Non Consumable	

assessment activities a work place	to: <ol style="list-style-type: none"> 1. Identify hazards or WHS issues in the workplace to relevant personnel 2. Assess and control risks according to own level of responsibility, in line with workplace procedures 3. Report hazards or WHS issues in the workplace to relevant personnel 4. Document risk control actions as required 		Theory: Practical:	<ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	
LU3: Follow emergency procedures workplace at	The trainee will be able to: <ol style="list-style-type: none"> 1. Report emergencies or incidents promptly to relevant personnel 2. Deal with emergencies in line with own level of 		Total Theory: Practical:	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia 	

	responsibility 3. Implement evacuation procedures as required			<ul style="list-style-type: none"> • Computer system with internet 	
LU3: Participate in OHS consultative processes	The trainee will be able to: <ol style="list-style-type: none"> 1. Contribute to workplace meetings, inspections or other consultative activities 2. Raise OHS (Occupational Health and Safety) issues with designated persons in accordance with organizational procedures 3. Take actions to eliminate workplace hazards or to reduce risks 		Total Theory: Practical:	Non Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	

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Module-4

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Module 4: Identify and Implement Workplace Policy and Procedures

Objective of the module: The aim of this module to get knowledge, skills and understanding to

Duration: 20 hours **Theory:** 00 hours **Practical:** 00 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1:Identify workplace policy & procedures	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Identify the workplace policy & procedures 2. Apply appropriate strategies that can be used to measure whether your workplace health and safety obligations are being met. 3. Assure the policies are realistic, resources and personnel to implement 4. Implement the policy & procedures that reflects the organizations 		<p>Total</p> <p>Theory:</p> <p>Practical:</p>	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	Class room

	<p>commitments</p> <p>5. Ensure the appropriate methods of implementation, outcomes and performance indicators</p>				
<p>LU2: Implement workplace policy & procedures</p>	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Apply and assign responsibility for recording systems to track continuous improvements in policy & procedures 2. Implement strategies for continuous improvement in effective and efficient information 		<p>Total</p> <p>Theory:</p> <p>Practical:</p>	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	<p>Class room</p>
<p>LU3: Communicate workplace policy & procedures</p>	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Communicate procedures to help implement workplace 		<p>Total</p> <p>Theory:</p> <p>Practical:</p>	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners 	<p>Class room</p>

	<p>policy</p> <p>2. Inform those involved in implementing the policy about expected outcomes, activities to be undertaken and assigned responsibilities</p>			<p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	
<p>LU4: Review the implementation of workplace policy & procedures</p>	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Identify the trends that may require remedial actions 2. Record the trends that may require remedial actions. 3. Ensure policy and procedures as required are made for continuous improvement of performance 		<p>Total</p> <p>Theory:</p> <p>Practical:</p>	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	Class room

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Module-5

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Module 5: Communicate at workplace

Objective of the module: The aim of this module to get knowledge, skills and understanding to communicate at workplace

Duration: 30 hours **Theory:** 00 hours **Practical:** 00 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Communicate within the organization	The trainee will be able to: <ol style="list-style-type: none"> 1. Communicate within a department. 2. Communication with other departments. 3. Use various media to communicate effectively. 4. Communicate orally and written 		Total Theory: Practical:	Non Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	
LU2: Communicate outside the organization	The trainee will be able to: <ol style="list-style-type: none"> 1. Deal with vendors 2. Deal with clients/customers Interact with other organisations. 3. Use various media to communicate effectively 4. Work with people of different cultures / backgrounds 		Total Theory: Practical:	Non Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer 	

				system with internet	
LU3: Communicate effectively in workgroup	The trainee will be able to: <ol style="list-style-type: none"> 1. Assess the issues to provide relevant suggestion to group members 2. Resolve the issues/problems /conflicts within the group 3. Arrange group working sessions to increase the level of participation in the group processes 4. Communicate messages to group members clearly to ensure interpretation is valid 5. Communicate style /manner to reflect professional standards/ awareness of appropriate cultural practices 6. Act upon constructive feedback 		Total Theory: Practical:	Non Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	
LU4: Communicate in writing	The trainee will be able to: <ol style="list-style-type: none"> 1. Identify relevant procedures for written information 		Total Theory:	Non Consumable <ul style="list-style-type: none"> • Notebooks • Pencils 	

	<p>2. Use strategies to ensure correct communication in writing .i.e.</p> <ul style="list-style-type: none"> • correct composition • clarity • comprehensiveness • accuracy • appropriateness <p>3. Draft assigned written information for approval, ensuring it is written within designated timeframes</p> <p>4. Ensure written information meets required standards of style, format and detail</p> <p>5. Seek assistance / feedback to aid communication skills development</p>		<p>Practical:</p>	<ul style="list-style-type: none"> • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet 	
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Module-6

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Module 6: Perform Computer Application Skills

Objective of the module: The aim of this module to get knowledge, skills and understanding to

Duration: 40 hours **Theory:** 00 hours **Practical:** 00 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Prepare In-page documents as per required information	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Set keyboard preferences according to information requirements 2. Layout Page according to information requirements 3. Toggle between Languages 4. Identify the usage of tool bar 5. Insert Columns as per requirement 6. Print the document 		<p>Total</p> <p>Theory:</p> <p>Practical:</p>	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	Computer Lab
LU2: Prepare Spreadsheets as per required	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Create workbook 		Total	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils 	Computer Lab

information	<p>according to information requirements</p> <ol style="list-style-type: none"> 2. Insert sheet according to information requirements 3. Enter basic formulae / functions using cell referencing when required 4. Correct formulas when error messages occur 5. Use a range of common tools during spreadsheet development 6. Edit columns and rows within the spreadsheet Filter data 7. Save the spreadsheet to a folder on a storage device 		<p>Theory:</p> <p>Practical:</p>	<ul style="list-style-type: none"> • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	
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	8. Format spreadsheet using formatting features as required 9. Incorporate object and chart in spreadsheet 10. Print spreadsheet				
LU3: Use MS Office as per required information	The trainee will be able to: <ol style="list-style-type: none"> 1. Use Microsoft Word for documentation 2. Use Microsoft Excel for documentation 3. Use Microsoft PowerPoint for presentation 4. Perform OneNote 5. Perform Outlook for emails 6. Perform Publisher applications 		Total Theory: Practical:	Non Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	Computer Lab
LU4: Perform computer graphics in basic applications	The trainee will be able to: <ol style="list-style-type: none"> 1. Perform graphic fundamentals in basic applications 		Total Theory:	Non Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners 	Computer Lab

	<ol style="list-style-type: none"> 2. Draw Points and lines to make images 3. Draw Dots in space to make images 4. Draw lightening blot Shapes to make images 5. Enlarge circles and rectangles to block in forms 		Practical:	Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	
LU4: Create Email account for communications	The trainee will be able to: <ol style="list-style-type: none"> 1. Make email account for communications 2. Compose text of an email message according to organizational guidelines as required 3. Create an automatic signature for the user 4. Attach files to email message where required 5. Send email message 		Total Theory: Practical:	Non Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	Computer Lab

	<p>6. Reply to / forward a received message using available features</p> <p>7. Save an attachment to the relevant folder</p> <p>8. Save email message using available settings</p> <p>9. Adjust email accounts to restrict and quarantine possible email security problems</p> <p>10. Print email message as per requirements</p>				
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INDUSTRIAL AUTOMATION



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Module-7
CBT CURRICULUM
National Vocational Certificate Level 3

Version 1 - July, 2019

Module 7: Manage Personal Finances

Objective of the module: The aim of this module to get knowledge, skills and understanding to

Duration: 30 hours **Theory:** 00 hours **Practical:** 00 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Develop a personal budget	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> 1. Calculate current living expenses using available information to prepare a personal budget. 2. Keep a record of all income and expenses for a short period of time to help estimate ongoing expenses. 3. Subtract total expenses from total income to determine a surplus or deficit budget for the specified period. 4. Find reasons for a deficit budget and ways to reduce expenditure identified. 5. Identify ways to increase income 		<p>Total</p> <p>Theory:</p> <p>Practical:</p>	<p>Non Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Computer system with internet 	Class room
LU2: Develop	The trainee will be able to:		Total	Non Consumable	Class room

long term personal budget	<ol style="list-style-type: none"> Analyze income and expenditure and set long term personal financial goals. Develop a long-term budget based on the outcomes of short-term budgeting. Identify obstacles that might affect the business Formulate a regular savings plan based on budget 		<p>Theory:</p> <p>Practical:</p>	<ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpener <p>Non Consumable</p> <ul style="list-style-type: none"> White board Multimedia Computer system with internet 	
LU3: Identify ways to maximize future finances	<p>The trainee will be able to:</p> <ol style="list-style-type: none"> Determine sources to maximize personal income, Get further education or training to maintain or improve future income. Identify the need for debt to finance living and other expenses, Determine the appropriate levels of debt and repayment. Consolidate existing debt, where possible, to minimize 		<p>Total</p> <p>Theory:</p> <p>Practical:</p>	<p>Non Consumable</p> <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpener <p>Non Consumable</p> <ul style="list-style-type: none"> White board Multimedia Computer system with internet 	Class room

	interest costs and fees. 6. Seek professional money management services.				
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General assessment guidance for “Industrial Automation Level-3”

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

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

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

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

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

Methods of assessment

For lessons with a high quantity of theory, written or oral tests related to learning outcomes and/ or learning content can be conducted. For workplace lessons, assessment can focus on the quality of planning the related process, the quality of executing the process, the quality of the product and/or evaluation of the process.

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

Examples for direct assessment of Industrial Automation include:

- Work performances, for example making a program in PLC for a particular application and interfacing with external interfaces (Discrete devices, analog devices, Hydraulic devices and pneumatic devices.
- Work Performances, for example designing the HMI for particular application and perform monitoring and controlling through HMI.
- Demonstrations, for example Timer Operations in PLC.

- Direct questioning, where the assessor would ask the student why he is preparing for a particular application.
- Paper-based tests, such as short answer questions on health and safety, communication skills etc.

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

Examples for indirect assessment of Industrial Automation include:

- Work products, such as different procedures of First Aids etc.
- Workplace documents, such as a report on health and safety etc.

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

Principles of assessment

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

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

Validity means that a valid assessment assesses what it claims to assess. For example, if complex electric circuit needs to be analyzed and certificated, the assessment should be involved according to performance criteria that are directly related to that particular circuit.

Reliability means that the assessment is consistent and reproducible. The results for the particular application should be the same.

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

Assessment strategy for Industrial Automation

This curriculum consists of 7 modules:

- Module 1: Perform Programmable Logic Controller Operations(PLC)
- Module 2: Develop Human Machine Interface(HMI)
- Module 3: Apply Work Health and Safety Practices (WHS)
- Module 4: Identify and Implement Workplace Policy and Procedures
- Module 5: Communicate at Workplace
- Module 6: Perform Computer Application Skills
- Module 7: Manage Personal Finances

Sessional assessment

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

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

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

Final assessment

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

The final theoretical assessment shall consist of short-answer questions. This part shall cover the technical, functional and generic modules:

For Level -3

- Module 1: Perform Programmable Logic Controller Operations(PLC)
- Module 2: Develop Human Machine Interface(HMI)
- Module 3: Apply Work Health and Safety Practices (WHS)

- Module 4: Identify and Implement Workplace Policy and Procedures
- Module 5: Communicate at Workplace
- Module 6: Perform Computer Application Skills
- Module 7: Manage Personal Finances

For the final practical assessment of Level -3, each student shall be assessed over a period of one day, with Four hour sessions. This represents a total of two sessions totaling 8 hours of practical assessment for each student. During this period, each student must be assessed on his/her ability to the following parameters of industrial automation;

- Designing
- Configuration
- Installation
- Interfacing
- Programming
- Operating
- Controlling
- Monitoring

Module 3: Apply Work Health and Safety Practices (WHS), Module 4: Identify and Implement Workplace Policy and Procedures, Module 5: Communicate at Workplace not be assessed separately, but must be assessed during practical sessions.

There is no final practical assessment for Module 6: Perform Computer Application Skills, Module 7: Manage Personal Finances. Practical work for these modules shall be assessed on a sessional basis only.

The assessment team

The number of assessors must meet the needs of the students and the training provider. For example, where two assessors are conducting the assessment, there must be a maximum of five students per assessor. In this example, a group of 20 students shall therefore require assessments to be carried out over a day period. For a group of only 10 students, assessments would be carried out over a day period only.

Planning for assessment

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

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

Complete List of Tools and Equipment

Sr#	Description	Quantity
1.	PLC Software application	01
2.	HMI software application	01
3.	External timer and counters	05
4.	Long Nose Pliers	20
5.	Screw Driver Set Plus and Minus	20
6.	Soldering Iron	20
7.	Soldering let	20
8.	Pliers	20
9.	Cable Cutter	20
10.	Wire Stripper	20
11.	Crimping Tool (RJ-45, RJ-17)	10
12.	Cable Lug Crimper	10
13.	DMM (Digital Multi meter Clamp Type)	20
14.	<p>PLC and HMI Trainer (Siemens, Mitsubishi, Allen Bradley, Fatek, Delta, ABB)</p> <p>Power Supply (5V, -10V, 10V, 24V), PLC CPU, Interface Modules, Digital I/Os Modules, Analogue I/Os Modules, Function Modules, Communication Cables, Touch Panel 10", Relevant Software with License Interface:</p> <p>Digital I/Os Components:</p> <p>Selector Switches, Toggle Switches, Binary Coded Decimal (BCD) Input Wheel, Proximity Switches LEDs, 7 Segment Display (BCD), Conveyor Belt with Actuators and Sensors, Relays, Magnetic</p>	10

	<p>Contactors</p> <p>Analogue I/Os Components:</p> <p>Temperature Sensors (PT-100 and Thermocouple), Humidity Sensors, Pressure Sensors, Multi Turn Variable (10 K), Analogue Voltmeter (-10 to 10 V), Ampere Meter (0 to 20 mA), Flow Control Valves (4 to 20 mA)</p>	
15.	<p>Pneumatic Trainer:</p> <p>Pneumatic Cylinders, Solenoid Valves (different types), Flow Control Valves(24 VDC), Pneumatic Gauge, Filter ,Regulator, Lubricator (FRL regulator), Pressure Switch, Compressor, Pneumatic Motor, Limit Switch, Power Supply (24V,10Amp), All Pneumatic Accessories</p>	2
16.	<p>Hydraulic Trainer:</p> <p>Hydraulic Cylinders, Solenoid Valves (different types), Flow Control Valves(24 VDC), Hydraulic Gauge, Filter ,Regulator, Lubricator (FRL regulator), Pressure Switch, Hydraulic Unit , Limit Switch, Power Supply (24V,10Amp), All Hydraulic Accessories, Pressure Release Valves , Proportional Control Valve, Hydraulic Motor,</p>	2
17.	LAN Tester	5
18.	Cable Tracer	5
19.	Magnetic Contactors with Auxiliaries (24VDC coil, SK 10 Amp)	100
20.	Thermal and Electronic Overload (0 to 6 Amp)	10 Each
21.	Breakers with Auxiliaries (Single-Phase, Two Poles, Three Poles) 5Amp	30 Each
22.	Relays (5-Amp,24 VDC)	50
23.	Relays (1-Amp,220 VAC)	50
24.	Timer Relays	20
25.	Push Buttons	100
26.	24V Panel Indicators (Red, Yellow, Green)	100

		Each color
27.	Selector Switches (Two Way, One Way)	20 Each
28.	Limit Switches	20
29.	Pressure Switches (up to 15 bar)	20
30.	Humidity Sensor	20
31.	Temperature Sensors-(PT100)	20
32.	Temperature Sensors-(Thermo Couple K Type)	20
33.	Temperature Controller (For PT100)	10
34.	Temperature Controller (For Thermo Couple)	10
35.	Proximity Switches-(Capacitive-PNP Four Wire)	20
36.	Proximity Switches-(Inductive-PNP Four Wire)	20
37.	Proximity Switches-(Retro Reflective-PNP Three Wire)	20
38.	Proximity Switches-(Capacitive-NPN Four Wire)	20
39.	Proximity Switches-(Inductive-NPN Four Wire)	20
40.	Proximity Switches-(Retro Reflective-NPN Three Wire)	20
41.	PLC (Siemens S7-1200)	2
42.	PLC (Mitsubishi FX3U)	2
43.	PLC (Fatek FBS32MR)	2
44.	PLC (ABB AC-500)	2
45.	PLC (Delta ES2-R)	2
46.	10" HMI Axis Module (Syntec HC Series)	2
47.	Power Supply 24VDC, 10 Amp	20
48.	Power Cable Single Core (1mm, 1.5 mm, 4mm) (Red, Black, Yellow, Green)	5 coils of each color
49.	Computer System (Core i7) with internet	20
50.	Cable lugs (U , I & O Type) 1mm, 1.5 mm, 4mm	20 Packet Each
51.	Cable lugs (U , I & O Type) 1mm, 1.5 mm, 4mm	20 Packet Each
52.	Over/Under/Phase Failure Load Relays	20

53.	Cable Tie (Small & Medium)	200 Packet Each
54.	Air Blower	1
55.	PPEs (Safety Goggles, Safety Gloves, Ear Plugs, Anti-Static Gloves, Safety Helmet, Safety Shoes, Apron, Mask, Respirator)	20 Each
56.	First Aid Box	2
57.	First Aid Kit	1
58.	Fire extinguisher	2
59.	Air Blower	
60.	Allen key set (mm size)	20
61.	Allen key set (inch size)	20
62.	Sockets set	2
63.	Electrical tool kit	10
64.	DC relays (24 VDC)	20
65.	DC indicator (24 VDC)	05
66.	Digital I Multi-meter	20
67.	Terminal blocks	10
68.	AC relays (220 VAC)	20
69.	AC indicator (220 VAC)	10
70.	Magnetic contactor (220 VAC)	10
71.	Overload relays	10
72.	Under voltage relay	05
73.	Three phase AC motors	05
74.	Single phase AC motors	05
75.	Variable power supply	10
76.	Memory devices	10
77.	Analog sensor module	05
78.	Printer	1
79.	Multimedia	1
80.	Whiteboard	1

List of Consumable Supplies

1. Oil
2. Label (Tags - Alphabetically & Number wise)
3. Note books
4. Pen
5. Pencils
6. Sharpeners
7. Erasers
8. White board markers(Different colors)
9. A4 papers
10. Internet
11. Control Wires
12. Thimbles
13. Batteries/cell for power backup

Credit values

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

The credit values are as follows:

Competency Standard	Estimate of hours	Credit
A: Perform Programmable Logic Controller Operations(PLC)	420	42
B: Develop Human Machine Interface(HMI)	110	11
C: Apply Work Health and Safety Practices (WHS)	30	3
D: Identify and Implement Workplace Policy and Procedures	20	2
E: Communicate at Workplace	30	3
F: Perform Computer Application Skills	40	4
G: Manage Personal Finances	30	3

