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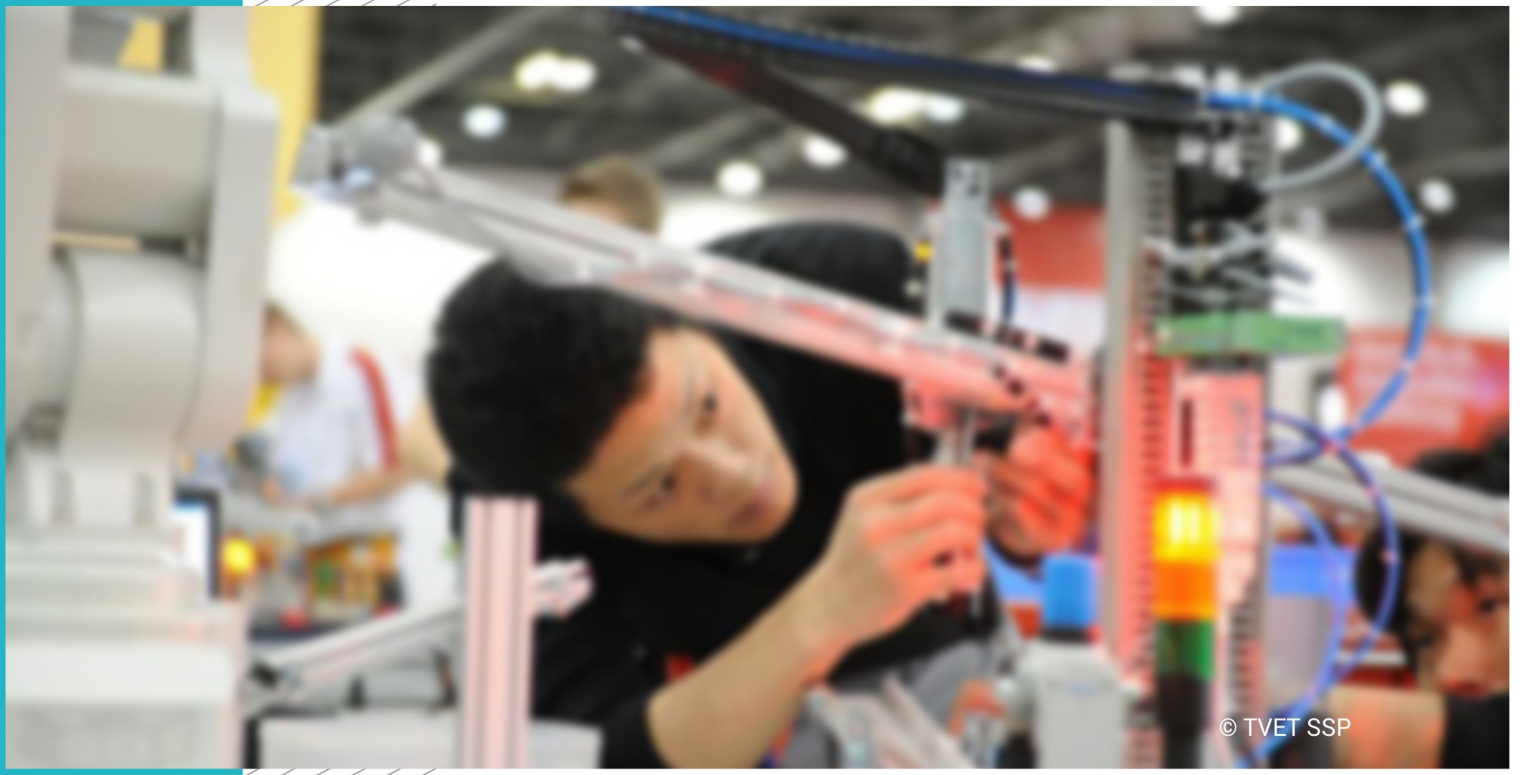
INDUSTRIAL AUTOMATION



CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - July, 2019

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INDUSTRIAL AUTOMATION

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Introduction

Definition/ Description of the training programme for *Industrial Automation Level -2*

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:

Apply Electric Circuit Concepts

Install Automation Instruments

Comply Personal Health and Safety Guidelines

Communicate the Workplace Policy and Procedure

Perform Basic Communication (Specific)

Perform Basic Computer Application (Specific)

Perform Basic Computer Operations

Perform Computer Application Skills

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

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 for the completion of this course is 410 hours. Delivery of the course could therefore be full time, 6 days a week, for 04 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: Apply Electric Circuit Concepts	28	112	140
Module 2: Install Automation Instruments	22	88	110
Module 3: Comply Personal Health and Safety Guidelines	00	00	30
Module 4: Communicate the Workplace Policy and Procedure	00	00	20
Module 5: Perform Basic Communication (Specific)	00	00	30
Module 6: Perform Basic Computer Application (Specific)	00	00	40
Module 7: Perform Basic Computer Operations	8	32	40

[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. Module7 is related to computer skills desirable to learn Industrial Controls and Automation. Modules 3& 6 are related to Occupational Health, Safety, Computer applications. Further modules 4 & 5 are 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:

<table>
<tr><td>Module 1:
Apply Electric Circuit Concepts
140 Hours</td><td rowspan="2">Module 3:
Comply Personal Health and Safety Guidelines
30 Hours</td><td>Module 4:
Communicate the Workplace Policy and Procedure
20 Hours</td></tr>
<tr><td>Module 2:
Install Automation Instruments
110 Hours</td><td rowspan="2">Module 7:
Perform Basic Computer Operations
40 Hours</td></tr>
<tr><td>Module 5:
Perform Basic Communication (Specific)
30 Hours</td><td>Module 6:
Perform Basic Communication (Specific)
30 Hours</td></tr>
</table>

Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 1: 071400935 Apply Electric Circuit Concepts **Aim:** The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts	**LU1:** Perform measurement of electrical quantities using meters **LU2:** Perform calculations of electrical quantities **LU3:** Use electric diagrams and symbols **LU4:** Terminate cables and circuit accessories **LU5:** Install DC Circuits wiring **LU6:** Install AC circuit wiring	28	112	140
Module 2: 071400936 Install Automation Instruments **Aim:** The aim of this module to get knowledge, skills and understanding to install automation instruments	**LU1:** Install Digital Instruments **LU2:** Install Analogue Instruments **LU3:** Install Hydraulic and Pneumatic Equipment	22	88	110
Module 3: Comply Personal Health and Safety Guidelines **Aim:**	**LU1:** Identify Personal Hazards at Workplace **LU2:** Apply Personal Protective and Safety Equipment (PPE) **LU3:** Comply Occupational Safety and Health (OSH) **LU4:** Dispose of hazardous Waste/materials from the designated area	00	00	30
Module 4: Communicate the Workplace Policy and Procedure **Aim:**	**LU1:** Identify workplace communication procedures **LU2:** Communicate at workplace **LU3:** Draft Written Information **LU4:** Review Documents	00	00	20
Module 5: Perform Basic Communication (Specific) **Aim:**	**LU1:** Communicate in a team to achieve intended outcomes **LU2:** Follow Supervisor's instructions as per organizational SOPs **LU3:** Develop Generic communication skills at workplace	00	00	30

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 6: Perform Basic Computer Application (Specific) **Aim:**	**LU1:** Create Word Documents **LU2:** Use internet for Browsing	00	00	40
Module 7: Perform Basic computer operations **Aim:** The aim of this module to get knowledge, skills and understanding to perform basic computer operations	**LU1:** Configure Computer System **LU2:** Prepare a MS word document **LU3:** Prepare Spreadsheet in MS Excel **LU4:** Prepare presentation in MS Power Point **LU5:** Prepare Electrical Drawings in MS Visio	8	32	40

INDUSTRIAL AUTOMATION

Module-1

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - July, 2019

Modules

Module 1: 071400935 Apply Electric Circuit Concepts

Objective of the module: The aim of this module to get knowledge, skills and understanding to apply electric circuit concepts

Duration: 140 hours **Theory:** 28 hours **Practical:** 112 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Perform measurement of electrical quantities using meters	**The trainee will be able to:** 1. Test electrical components as per requirement 2. Test electrical quantities as per requirement	Understanding of basic concepts of electrical quantities such as voltage, current and their units. Understanding of active and passive components including resisters, capacitors, inductors, diodes & transistors. Understanding of different electrical energy sources and their measurement principles while adhering to standard earthing and grounding practice. Understanding of different modes of digital multi-meter (Clamp meter, DMM) along with their corresponding levels/grades. Recording the measured quantities by connecting the components of multi-meter. Measurement of current & voltage for a single loop circuit. Differentiating between working and faulty electrical components.	**Total:** 20 hrs **Theory:** 6hrs **Practical:** 14 hrs	**Consumable** • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet • Variable Power Supply • Digital Multi-Meter • Assorted electrical	Class room / Lab / Workshop

				components (Active & Passive) • Jumper wire • Project boards	
LU2: Perform calculations of electrical quantities	**The trainee will be able to:** 1. Calculate current, voltage, resistance and power of a circuit as per requirement 2. Solve series & parallel circuits as per requirement	Study the basics of ohms law. Basic concept of series and parallel circuits with calculations. Operational knowledge of power and energy calculation for basic circuits. Power calculations for selecting AC & DC sources.	**Total** 20 hrs **Theory:** 6 hrs **Practical:** 14 hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet • Power Supply (with AC/DC source) • Digital Multi-Meter • Assorted electrical components	Class room / Lab / Workshop

				(Active & Passive) • Jumper wire • Project boards • Watt Meter	
LU3: Use electric diagrams and symbols	**The trainee will be able to:** 1. Identify electrical and control symbols for components as per requirement 2. Draw electrical single line diagrams manually as per requirement.	Study standard symbols for electrical and control components and practice manual or computer-based drawing. Reading and understanding given standard drawing for power and control circuits. Draw single line diagrams for power and control circuits while understanding the basic working knowledge.	**Total** 15hrs **Theory:** 4 hrs **Practical:** 11hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet • Drawing sheets & tools • Electrical components stencil	Class room / Lab / Workshop
LU4: Terminate cables and circuit accessories	**The trainee will be able to:** 1. Select tools and accessories as per	Differentiate between cable and wire. Different type of AC cables for single phase and three phase (with details of color coding, core specifications, wire gauges, and material, shielding and insulation	**Total:** 10 hrs **Theory:** 2hrs	Consumable • Notebooks • Pencils • Erasers	Class room / Lab / Workshop

	requirement 2. Lay down cables as per requirement	specification). Different type of DC cables (with details of rating, wire sizing and material, shielding and insulation specifications). Knowledge of cable-selection tables as per international standards.	**Practical:** 8 hrs	• Sharpeners Non Consumable • White board • Multimedia • Computer system with internet	
LU5: Install DC Circuits wiring	**The trainee will be able to:** 1. Select wiring tools, components, accessories and cables as per requirement **2.** Connect DC components as per requirement	Introduction to tools and accessories for DC Wiring. Connecting different components of DC circuits according to terminal tags and labels as per standard diagrams. Compare the observed results with the desired results of implemented DC circuits. Study of DC relays and switches. Understand latching and unlatching circuit with DC wiring. Knowledge of different types of logic gates.	**Total** 25 hrs **Theory:** 5 hrs **Practical:** 20 hrs	Consumable • White board • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • Multimedia • Computer system with internet • Electrical tool kit. • DC relays (24 VDC) • Switches • Push buttons • DC indicator	Class room / Lab / Workshop

				(24 VDC) • Multi-meter • Terminal blocks	
LU6: Install AC circuit wiring	**The trainee will be able to:** 1. Select wiring tools, accessories and cables as per requirement **2.** Connect AC components as per requirement	Introduction to tools and accessories for AC wiring. Types of cables. Connecting different components of AC circuits according to terminal tags and labels as per standard diagrams. Compare the observed results with the desired results of implemented AC circuits. Study of AC relays, contactors and switches. Differentiate the single phase and three phase electrical wiring. Understand reverse-forward, star-delta and DOL (Direct Online) operations for motors using relay logic.	**Total** 50 hrs **Theory:** 5 hrs **Practical:** 45 hrs	Consumable • White board • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • Multimedia • Computer system with internet • Electrical tool kit. • AC relays (220 VAC) • Switches • Push buttons • AC indicator (220 VAC) • Multi-meter • Terminal	Class room / Lab / Workshop

				blocks • Magnetic contactor (220 VAC) • Timer relay (220 VAC) • Overload relays • Circuit breaker • Under voltage relay • Three phase AC motors • Single phase AC motors	

INDUSTRIAL AUTOMATION

Module-2

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - July, 2019

Module 2: 071400936 Install Automation Instruments

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

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Install Digital Instruments	**The trainee will be able to:** 1. Select tools and accessories as per requirement 2. Identify digital instruments as per requirement 3. Install digital instruments as per requirement 4. Operate digital instruments as per requirement	Knowledge of basic terminologies related to digital electronics with respect to industrial automation • Normally open • Normally close • NPN switching • PNP switching • Transmitter & Receiver Identification of different tools used with digital instruments (Digital multi-meter, Electrical Tools kit) Study and operational knowledge of different digital instruments (e.g. Photo Sensor, capacitive Sensor, Inductive Sensor, Solenoid, Micro Switches, Pressure Switches etc). Understanding the sensor interface types (Two wires and three wires). Understanding the digital instruments datasheets. Connecting the sensors for final operation and check for any faults.	**Total** 20 hrs **Theory:** 5 hrs **Practical:** 15 hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet • Digital Trainer • Jumper wires • Variable power supply • Seven segment display • Gate ics • 555 Timer ic	Class room / Lab / Workshop

				• LCD • Indicators • Memory devices	
LU2: Install Analogue Instruments	**The trainee will be able to:** 1. Select tools and accessories as per requirement 2. Identify Instruments for different output signals as per requirement 3. Install Analogue Instruments as per requirement	Knowledge of basic terminologies related to analogue electronics • Signal Conversions (ADC & DAC) • Amplification • Signal conditioning • Strain gauge • Analogue signal types & levels Study and operational knowledge of different analogue instruments (Temperature sensor, Pressure sensor, Flow sensor, Level sensor, Load cell). Understanding the sensor interface types (Two wires, three wires and four wires). Understand analogue instruments datasheets. Connecting the sensors for final operation and check for any faults.	**Total** 40 **Theory:** 8 hrs **Practical:** 32	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet • Analogue/meter Trainer • Jumper wires • Variable power supply • Indicators • Ammeter • Voltmeter • Galvanometer	Class room / Lab / Workshop

				• Analog multimeter • Analog sensor module	

LU3: Install Hydraulic and Pneumatic Equipment	**The trainee will be able to:**
	1. Select tools as per requirement
	2. Identify hydraulic and pneumatic symbols
	3. Draw hydraulic and pneumatic systems diagrams manually
	4. Identify different hydraulic components and instruments as per requirement
	5. Install hydraulic components and instruments as per requirement
	6. Operate hydraulic equipment as per
		Identification and selection of various tools as per job requirement to install hydraulic and pneumatic systems.
		
		Study of the hydraulic and pneumatic systems; symbols; diagram; sources; equipment;
		
		Operational knowledge of various hydraulic and pneumatic valves and actuators
		• DCV (directional control valve)
		  ○ shuttle valve
		  ○ check valve
		  ○ 2/2-way valve
		  ○ 3/2-way valve
		  ○ 5/2-way valve
		  ○ 5/3-way valve
		• PCV (pressure control valve)
		  ○ Pressure limiting
		  ▪ Pressure reducing valve
		  ▪ Pressure relief valve
		  ○ Pressure regulator
		  ○ Pressure sequencing valve
		• Limit switches
		• Pressure gauges
		• Rotary actuators
		• Types of cylinder (single acting; double acting)
		
		Study different valve actuation methods (e.g. lever operated, pilot operated, solenoid operated etc); symbols of levers and valve
			Total
			50 hrs
			Theory:
			9 hrs
			Practical:
			41 hrs
				Consumable
				• White board
				• Notebooks
				• Pencils
				• Erasers
				Non Consumable
				• Sharpeners
				• Multimedia
				• Computer system with internet
				• Hydraulic boards
				• Pneumatic boards
				• Compressor
				• Oil
				• Oil tank
				• Motor
				• Pump
					Class room / Lab / Workshop

	requirement 7. Identify different Pneumatic components and instruments as per requirement 8. Install pneumatic components and instruments as per requirement 9. Operate pneumatic equipment as per requirement 10. Troubleshoot hydraulic and pneumatic system	Operational knowledge of cascade control; cylinder sequencing. Understand the troubleshooting techniques; safety practices during pneumatics and hydraulic operations.		• Different DCV (directional control valve) • Different PCV (pressure control valve) • Single and double acting cylinders for both hydraulic and pneumatic systems • Limit switches • Rotary actuators • Filter • Pressure regulator • Pressure relief valve • Connecting pipes	

INDUSTRIAL AUTOMATION

Module-3

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - July, 2019

Module 3: Comply with Perform Personal Health and Safety Guidelines

Objective of the module: The aim of this module to get knowledge, skills and understanding to maintain personal health, hygiene and safety

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Identify Hazards at Workplace	**The trainee will be able to:** 1. Identify risk to personal health 2. Identify hygiene and safety at work place 3. Identify processes 4. Identify tools, equipment and consumable materials that have the potential to cause harm 5. Report, identified risk to Health, hygiene and safety to concerned		**Total** 00 hrs **Theory:** 00 hrs **Practical:** 00hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet	Class room
LU2: Apply Personal	**The trainee will be able to:**		**Total**	Consumable	

Protective and Safety Equipment (PPE)	1. List the Personal Protective equipment 2. Select personal protective equipment in terms of type and quantity according to work orders. 3. Wear personal protective equipment according to job requirements. 4. Clean personal protective equipment 5. Stored Personal Protective equipments in proper place after use.		00hrs **Theory:** 00 hrs **Practical:** 00 hrs	• Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet • PPEs (Safety glasses, Ear muffs/ear plugs, Protective Gloves, Cap, Safety shoes etc.)	
LU3: Comply Occupational Safety and Health (OSH)	**The trainee will be able to:** 1. Maintain cleanliness and hygiene as per organizational policy 2. Comply with Health, hygiene and safety precautions before		**Total** 00 hrs **Theory:** 00 hrs **Practical:** 00hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board	

	starting work 3. Comply organizational Health, hygiene and safety guidelines during work 4. Deal with resolvable problems according to prescribed procedures 5. Report un resolvable problems to concerned			• Multimedia • Computer system with internet • Safety manuals	
LU4: Dispose of hazardous Waste/materials from the designated area.	**The trainee will be able to:** 1. Identify hazardous waste/ drug materials which needs to be disposed off 2. Segregate hazardous or non-hazardous waste carefully from the designated area as per approved procedure		**Total** 00hrs **Theory:** 00 hrs **Practical:** 00 hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet	

	3. Use proper disposal hazardous containers for dispose-off hazardous waste as per procedure 4. Take necessary precautions like putting masks and gloves while disposing hazardous waste/ materials as per standard operating procedure				

INDUSTRIAL AUTOMATION

Module-4

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - July, 2019

Module 4: Communicate the Workplace Policy and Procedure

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 communication procedures	**The trainee will be able to:** 1. Identify organizational communication requirements and workplace procedures with assistance from relevant authority 2. Identify appropriate lines of communication with supervisors and colleagues. 3. Seek advice on the communication method/equipment most appropriate for		**Total** **Theory:** **Practical:**	Consumable • Notebooks • Pen Non Consumable • White board • Multimedia • Computer system with internet	Class room

	the task				
LU2: Communicate at workplace	**The trainee will be able to:** 1. Use effective questioning, and active listening and speaking skills to gather and convey information 2. Use appropriate non-verbal behavior at all times 3. Encourage, acknowledge and act upon constructive feedback		**Total** **Theory:** **Practical:**	Consumable • Notebooks • Pen Non Consumable • White board • Multimedia • Computer system with internet	Class room
LU3: Draft Written Information	**The trainee will be able to:** 1. Identify and comply with required range of written materials in accordance with organizational policy and procedures 2. Draft and present		**Total** **Theory:** **Practical:**	Consumable • Notebooks Pen Non Consumable • White board • Multimedia • Computer system with	Class room

	assigned written information for approval, ensuring it is written clearly, concisely and within designated timeframes. 3. Ensure written information meets required standards of style, format and detail. 4. Seek assistance and/or feedback to aid communication skills development			internet	
LU3: Review Documents	**The trainee will be able to:** 1. Check draft for suitability of tone for audience, purpose, format and communication style 2. Check draft for readability,		**Total** **Theory:** **Practical:**	Consumable • Notebooks • Pen Non Consumable • White board • Multimedia • Computer system with internet	Class room

	grammar, spelling, sentence and paragraph construction and correct any inaccuracies or gaps in content. 3. Check draft for sequencing and structure 4. Check draft to ensure it meets organizational requirements **5.** Ensure draft is proofread, where appropriate, by supervisor or colleague				

INDUSTRIAL AUTOMATION

Module-5

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - July, 2019

Module 5: Perform Basic Communication (Specific)

Objective of the module: The aim of this module to get knowledge, skills and understanding to perform basic communication.

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Communicate in a team to achieve intended outcomes	**The trainee will be able to:** 1. Treat team members with respect 2. Maintain positive relationships to achieve common organizational goals 3. Get work related information from team 4. Identify interrelated work activities to avoid confusion 5. Adopt communication skills, which are designed in a team. 6. Identify problems in communication with a		**Total** **Theory:** **Practical:**	Consumable • Notebooks • Pencils • Erasers • Sharpeners • Pen Non Consumable • White board • Multimedia • Computer system with internet	Class room

	team 7. Resolve Communication barrier through discussion and mutual agreement				
LU2: Follow Supervisor's instructions as per organizational SOPs	**The trainee will be able to:** 1. Receive the instructions from Supervisor 2. Carry out the instructions of the supervisor 3. Report to the supervisor as per organizational SOPs		**Total** **Theory:** **Practical:**	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with internet • Pen	Class room
LU3: Develop Generic communication skills at workplace	**The trainee will be able to:** 1. Develop basic reading skills 2. Develop Basic writing Skills **3.** Develop basic		**Total** **Theory:** **Practical**	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board	Class room

	listening skills			• Multimedia • Computer system with internet • Pen	

INDUSTRIAL AUTOMATION

Module-6

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - July, 2019

Module 6: Perform Basic Computer Application (Specific)

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: Create Word Documents	**The trainee will be able to:** 1. Open word processing application 2. Create a word document 3. Customize page layout with relevant name setting 4. Set up page in a word document 5. Edit word document as required 6. Use simple formatting tools when creating the document 7. Save word document		**Total** **Theory:** **Practical:**	Consumable • Notebooks • Pencils • Erasers • Sharpeners • Pen Non Consumable • White board • Multimedia • Computer system with internet	Computer Lab

	to directory 8. Insert table in a word document 9. Insert appropriate images into document as necessary 10. Insert header/footer in a word document 11. Insert section break in a word document 12. Set style in word document 13. Select basic Print settings 14. Print the document				
LU2: Use internet for Browsing	**The trainee will be able to:** 1. Use search engines to open website 2. Search data on different topics 3. Refine search to increase relevance of information or content		**Total** **Theory:** **Practical:**	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer	Computer Lab

	4. Navigate a website to access the information or content required			system with internet • Pen	

INDUSTRIAL AUTOMATION

Module-7

CBT CURRICULUM

National Vocational Certificate Level 2

Version 1 - July, 2019

Module7: Perform Basic Computer Operations

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

Duration: 40 hours **Theory:** 8 hours **Practical:** 32 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Configure Computer System	**The trainee will be able to:** 1. Connect computer components and peripherals as per requirement 2. Install drivers and applications according to the software specification 3. Troubleshoot Applications to trace and fix faults in a specific application to bring it in a running condition	Demonstrate basic components and peripheral devices of computer system. Demonstrate knowledge and understanding of the following software's • Windows • MS Office • Google Docs, Sheets and Slides Install/uninstall computer software Demonstrate precautions while installing any software application Demonstrate troubleshooting of Hardware and software Follow health and safety procedure as per the requirements of given task.	**Total** 10 hrs **Theory:** 2 hrs **Practical:** 8 hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners • Duster • Marker Non Consumable • Computers for student • Computer/Laptop for Trainer • CD ROM • CD's • Internet Facilities • White Board • Multimedia • UPS • Data traveler /USB	Computer Lab
LU2: Prepare a MS word document	**The trainee will be able to:** 1. Compose a document as per the	Compose document in Word Processing and save document in • One drive location	**Total** 9 hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners	Computer Lab

	requirement
	2. Format Word Document according to given requirements
	3. Print Word Documents according to requirements
		• Computer location
		
		Format and modify document by using
		different
		• Editing tools
		  ○ Cut/copy/paste
		  ○ Undo/redo
		  ○ Delete/insert
		• Page orientation
		• Alignments
		• Headers/Footers
		• Page numbering
		• Page / Paragraph borders
		• Page size
		• Background color
		• Themes/Style
		• Page margin
		• Table of contents
		• References
		• Review option
		
		Operational knowledge of printing the document
		
		Apply different settings of print command to
			Theory:
			1 hrs
			
			Practical:
			8 hrs
				• Duster
				• Marker
				• Workbooks
				• Pen
				• Pages
				Non Consumable
				• Internet connection
				• Computers for student
				• Computer/Laptop for Trainer
				• White Board
				• Multimedia
				• UPS
				• Printer
				• Case studies	

		print documents.			
LU3: Prepare Spreadsheet in MS Excel	**The trainee will be able to:** 1. Develop a worksheet as per given data 2. Format the worksheet according to given criteria 3. Apply Formulas according to the requirement 4. Generate Charts/Graphs according to the given data 5. Print Worksheet according to requirements	Develop worksheet • Demonstrate the main parts of the Excel spreadsheet work area. • Tools bars • Formula bar • Work sheet • Name box • Column and rows • Functions Format cell to prepare worksheet. • Merge/Unmerge cells • Format • Number • Alignment • Table • Font • Protection • border Apply formula to functional the worksheet • Explain and demonstrate basics of creating a formula / function in spreadsheet • Apply formula to create different sheets as required. Demonstrate charts/graphs and its use in the excel sheets with examples • Create different kinds of charts like, o Line charts o pie chart o bar chart o column chart o scatter chart o etc	**Total** 9 hrs **Theory:** 2 hrs **Practical:** 7 hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners • Duster • Marker • Workbooks • Pen • Pages Non Consumable • Internet connection • Computers for student • Computer/Laptop for Trainer • White Board • Multimedia • UPS • Printer • Case studies	Computer Lab

LU4: Prepare presentation in MS Power Point	**The trainee will be able to:** 1. Insert Slides with different Layouts according to requirements of presentation 2. Insert text, tables, images, etc. according to the requirement 3. Apply a set of effects to animate the slide according to requirement 4. Apply Slide Transitions on Slides according to requirement 5. Apply Sound Effects on Objects/text/images according to requirement 6. Present a	Demonstrate the interface and different layouts of Power Point Define Master Slide as per options available in the software of Power Point. Demonstrate how to ○ Input text in slide ○ Create new slide ○ Create table within the slide ○ Apply different effects to data. ○ Apply different transition and animation. ○ Apply different design as a whole and also to a single slide. ○ Insert picture, shapes and action button in slides ○ Insert textbox, header/footer, date and numbering to slide.	**Total** 4 hrs **Theory:** 1 hrs **Practical:** 3 hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners • Duster • Marker • Workbooks • Pen • Pages Non Consumable • Internet connection • Computers for student • Computer/Laptop for Trainer • White Board • Multimedia • UPS • Printer • Case studies	Computer Lab

	presentation according to 7Cs of communication				
LU5: Prepare Electrical Drawings in MS Visio	**The trainee will be able to:** 1. Set the Page Layout, size and format as per requirement 2. Identify and Insert the Electrical symbols as per requirement 3. Modify the given electrical drawings **4.** Print the final electrical drawings	Demonstrate the interface and different tabs of Ms Visio Demonstrate how to ○ Understand the Interface ○ Apply the page layout ○ Customize UI ○ Create a drawing ○ Creating & arranging smart shapes ○ Connecting smart shapes ○ Align the smart shapes ○ Drag different charts ○ Use of Slide snippets ○ Use of presentation mode ○ Set diagram layout ○ Customize layout ○ Insert Text ○ Insert background	**Total** 8 hrs **Theory:** 2 hrs **Practical:** 6 hrs	Consumable • Notebooks • Pencils • Erasers • Sharpeners • Duster • Marker • Workbooks • Pen • Pages Non Consumable • Internet connection • Computers for student • Computer/Laptop for Trainer • White Board • Multimedia • UPS • Printer • Case studies	Computer Lab

General assessment guidance for *"Industrial Automation Level-2"*

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 measuring AC/DC Voltages/ Currents.
- Work Performances, for example wiring of Direct Online (DOL) circuits using Relays.
- Demonstrations, for example testing of digital instruments.
- 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: Apply Electric Circuit Concepts
- Module 2: Install Automation Instruments
- Module 3: Comply Personal Health and Safety Guidelines
- Module 4: Communicate the Workplace Policy and Procedure
- Module 5: Perform Basic Communication (Specific)
- Module 6: Perform Basic Computer Application (Specific)
- Module 7: Perform Basic Computer Operations

Sessional assessment

The Sesstional 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 -2

- Module 1: Apply Electric Circuit Concepts
- Module 2: Install Automation Instruments
- Module 3: Comply Personal Health and Safety Guidelines

- Module 4: Communicate the Workplace Policy and Procedure
- Module 5: Perform Basic Communication (Specific)
- Module 6: Perform Basic Computer Application (Specific)
- Module 7: Perform Basic Computer Operations

For the final practical assessment of Level-2 each student shall be assessed over a period of one day, with Four hour sessions 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
- Operating
- Monitoring

Module 3: Comply Personal Health and Safety Guidelines, Module 4: Communicate the Workplace Policy and Procedure, Module 5: Perform Basic Communication (Specific), not be assessed separately, but must be assessed during practical sessions.

There is no final practical assessment for Module 6: Perform Basic Computer Application (Specific), Module 7: Perform Basic Computer Operations. 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.	Long Nose Pliers	20
2.	Screw Driver Set Plus and Minus	20
3.	Soldering Iron	20
4.	Soldering let	20
5.	Pliers	20
6.	Cable Cutter	20
7.	Wire Stripper	20
8.	Crimping Tool (RJ-45, RJ-17)	10
9.	Cable Lug Crimper	10
10.	Variable Power Supply(with AC/DC source)	10
11.	Watt Meter	20
12.	DMM (Digital Multi meter Clamp Type)	20
13.	Electrical components stencil	20
14.	Pneumatic Trainer: 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	02
15.	Hydraulic Trainer: 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,	02
16.	Cable Tracer	05
17.	Magnetic Contactors with Auxiliaries (24VDC coil, SK 10 Amp)	100

18.	Thermal and Electronic Overload (0 to 6 Amp)	10 Each
19.	Breakers with Auxiliaries (Single-Phase, Two Poles, Three Poles) 5Amp	30 Each
20.	Relays (5-Amp,24 VDC)	50
21.	Relays (1-Amp,220 VAC)	50
22.	Timer Relays(220 VAC)	20
23.	Push Buttons	100
24.	24V Panel Indicators (Red, Yellow, Green)	100 Each color
25.	Selector Switches(Two Way, One Way)	20 Each
26.	Limit Switches	20
27.	Pressure Switches (up to 15 bar)	20
28.	Humidity Sensor	20
29.	Temperature Sensors-(PT100)	20
30.	Temperature Sensors-(Thermo Couple K Type)	20
31.	Temperature Controller (For PT100)	10
32.	Temperature Controller (For Thermo Couple)	10
33.	Proximity Switches-(Capacitive-PNP Four Wire)	20
34.	Proximity Switches-(Inductive-PNP Four Wire)	20
35.	Proximity Switches-(Retro Reflective-PNP Three Wire)	20
36.	Proximity Switches-(Capacitive-NPN Four Wire)	20
37.	Proximity Switches-(Inductive-NPN Four Wire)	20
38.	Proximity Switches-(Retro Reflective-NPN Three Wire)	20
39.	Power Supply 24VDC, 10 Amp	20
40.	Portable Wiring Trainer	20

41.	Power Cable Single Core (1mm, 1.5 mm, 4mm) (Red, Black, Yellow, Green)	5 coils of each color
42.	Computer System (Core i7) with internet	20
43.	Earth leakage Breaker	05
44.	Power Analyzer	02
45.	Over/Under/Phase Failure Load Relays	20
46.	Terminal Blocks	500
47.	Cable lugs (U , I & O Type) 1mm, 1.5 mm, 4mm	20 Packet Each
48.	Cable Tie (Small & Medium)	200 Packet Each
49.	Shrinkable Tube(2mm, 4mm, 6mm)	12 Meter Each
50.	Hammering Drill Machine	02
51.	Air Blower	01
52.	Slotted Trunking 25mm X 45mm-(2Meter Length)	10
53.	PPEs (Safety Goggles, Safety Gloves, Ear Plugs, Anti-Static Gloves, Safety Helmet, Safety Shoes, Apron, Mask, Respirator)	20 Each
54.	First Aid Box	02
55.	First Aid Kit	01
56.	Fire extinguisher	2
57.	Allen key set (mm size)	20
58.	Allen key set (inch size)	20
59.	Sockets set	02
60.	Electrical tool kit	10
61.	DC relays (24 VDC)	50
62.	DC indicator (24 VDC)	50
63.	Multi-meter	05

64.	Assorted electrical components (Active & Passive)	20
65.	Compressor	02
66.	Terminal blocks	05
67.	AC relays (220 VAC)	20
68.	AC indicator (220 VAC)	20
69.	Magnetic contactor (220 VAC)	10
70.	Timer relay (220 VAC)	05
71.	Overload relays	10
72.	Under voltage relay	20
73.	Three phase AC motors	05
74.	Single phase AC motors	05
75.	Variable power supply	05
76.	Seven segment display	20
77.	Gate ics	Pack of 25 each
78.	555 Timer ic	10
79.	LCD	10
80.	Indicators	20
81.	Memory devices	10
82.	Ammeter	10
83.	Voltmeter	10
84.	Galvanometer	10
85.	Analog multi- meter	10
86.	Analog sensor module	05
87.	Oil tank	05
88.	Pump	05
89.	Different DCV (directional control valve)	50
90.	Different PCV (pressure control valve)	10
91.	Single and double acting cylinders for both hydraulic and pneumatic systems	10
92.	Filter	10
93.	Pressure regulator	10
94.	Pressure relief valve	10

95.	Pressure Reducing Valve	10
96.	Valve having different actuation methods	05 set
97.	Connecting pipes	01
98.	White board	20
99.	Multimedia	01
100.	Printer	01

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. Drawing sheets
11. Batteries and Cells
12. Internet
13. Hydraulic Oil
14. Instrument Air
15. Control Wires
16. Thimbles

Credit Values

The credit value of the National Certificate Level -2 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: Apply Electric Circuit Concepts	140	14
B: Install Automation Instruments	110	10
C: Comply Personal Health and Safety Guidelines	30	3
D: Communicate the Workplace Policy and Procedure	20	2
E: Perform Basic Communication (Specific)	30	3
F: Perform Basic Computer Application (Specific)	40	4
G: Perform Basic Computer Operations	40	4

National Vocational and Technical Training Commission (NAVTTC)

Plot 38, Kirthar Road, Sector H-9/4, Islamabad, Pakistan
+92 51 9044 322
+92 51 9044 322
info@navttc.org
www.navttc.org