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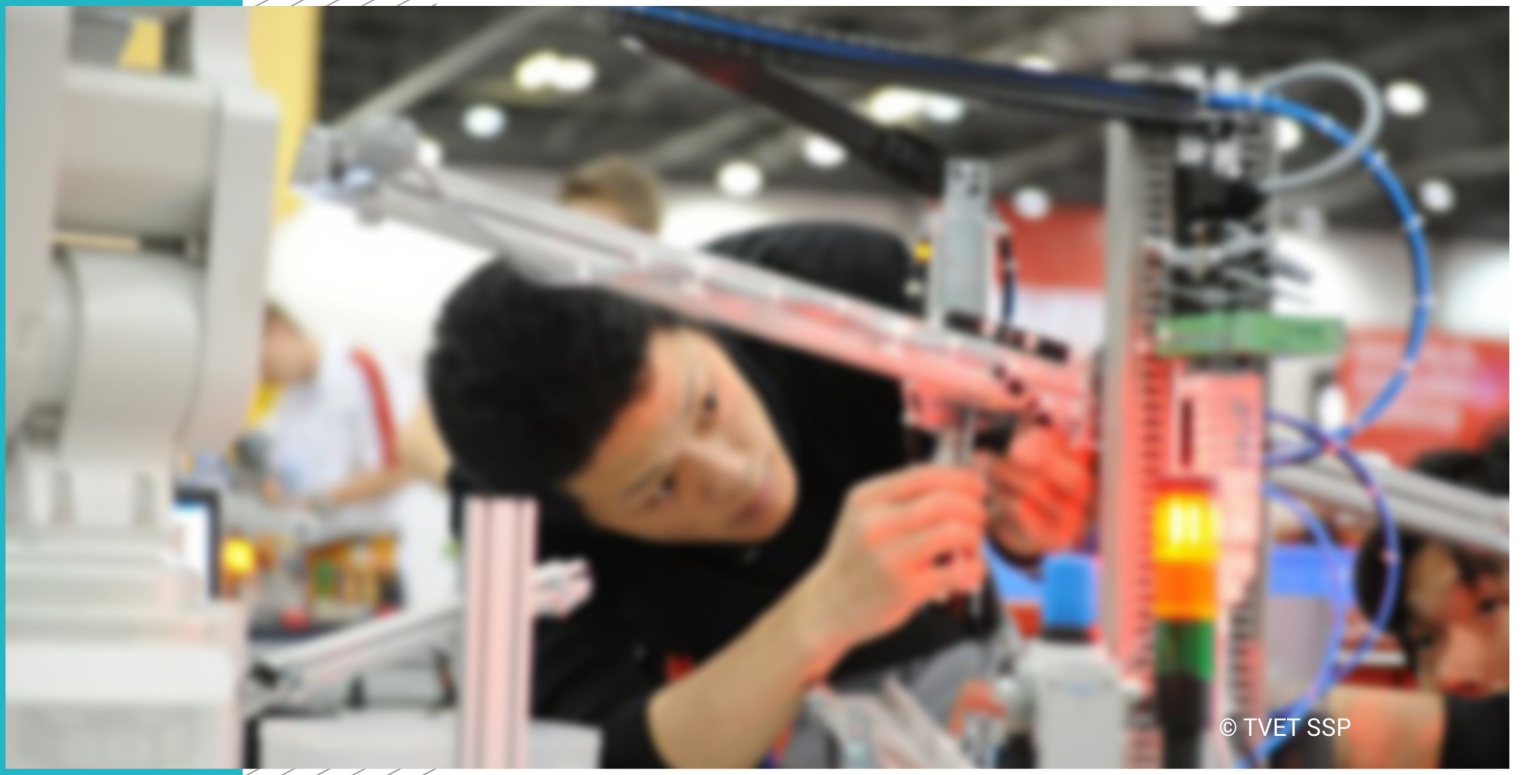
INDUSTRIAL AUTOMATION



CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

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INDUSTRIAL AUTOMATION

CBT CURRICULUM

National Vocational Certificate Level 4

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Introduction

Definition/ Description of the training programme for *Industrial Automation, Level-4*

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:

Configure AC Drives and Motors

Operate Industrial Robot

Contribute to Work Related Health and Safety (WHS) Initiatives

Analysis Workplace Policy and Procedures

Perform Advanced Communication

Develop Advance Computer Application Skills

Manage Human Resource Services

Develop Entrepreneurial Skills

Possible available job opportunities available immediately and later in the future

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

Trainee entry level

Level-3 in Industrial Automation

Minimum qualification of trainer

Industrial Automation CBT Level-IV Qualified with 03 Years Industry relevant experiences / BSc/B.Tech, Qualified with 03 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 8 modules. The recommended delivery time is 570 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: Configure AC Drives and Motors	50	200	250
Module 2: Operate Industrial Robot	28	112	140
Module 3: Contribute to Work Related Health and Safety (WHS) Initiatives	00	00	30
Module 4: Analysis Workplace Policy and Procedures	00	00	30
Module 5: Perform Advanced Communication	00	00	30
Module 6: Develop Advance Computer Application Skills	00	00	40
Module 7: Manage Human Resource Services	00	00	20
Module 8: Develop Entrepreneurial Skills	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 8 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. Module 6 is related to computer skills desirable to learn Industrial Controls and Automation. Modules 3, 7 & 8 are related to Work related Health & Safety, Computer applications, Human resource services and Entrepreneurial skills. Two further modules i.e. 4 & 5 are related to the Communication & workplace policies. 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 rowspan="4">Module 1:
Configure AC Drives and Motors
250 Hours</td><td>Module 5:
Perform Advanced Communication
30 Hours</td><td>Module 7:
Manage Human Resource Services
20 Hours</td></tr>
<tr><td>Module 4:
Analysis Workplace Policy and Procedures
30 Hours</td><td rowspan="3">Module 8:
Develop Entrepreneurial Skills
30 Hours</td></tr>
<tr><td>Module 3:
Contribute to Work Related Health and Safety (WHS) Initiatives
30 Hours</td></tr>
</table>

Module 2: Operate Industrial Robot 140 Hours		**Module 6:** Develop Advance Computer Application Skills 40 Hours

Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 1: Configure AC Drives and Motors **Aim:** The aim of this module to get knowledge, skills and understanding to configure ac drives and motors	**LU1:** Operate AC Drives and Motors **LU2:** Integrate AC Drives with PLC	50	200	250
Module 2: Operate Industrial Robot **Aim:** The aim of this module to get knowledge, skills and understanding to operate industrial robot	**LU1:** Install industrial robot **LU2:** Develop programs for robotic applications **LU3:** Troubleshoot / Debug Robot	28	112	140
Module 3: Contribute to Work Related Health and Safety (WHS) Initiatives **Aim:**	**LU1:** Contribute to initiate work-related health and safety measures **LU2:** Contribute to establish work-related health and safety measures **LU3:** Contribute to ensure legal requirements of WHS measures **LU4:** Contribute to review WHS measures **LU5:** Evaluate the organization's WHS system	00	00	30
Module 4: Comply with Workplace Policy and Procedures **Aim:**	**LU1:** Manage work timeframes **LU2:** Manage to convene meeting **LU3:** Decision making at workplace **LU4:** Set and meet own work priorities at instant **LU5:** Develop and maintain professional competence **LU6:** Follow and implement work safety requirements	00	00	30

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 5: Perform Advanced Communication **Aim:**	**LU1:** Demonstrate professional skills **LU2:** Plan and Organize work **LU3:** Provide trainings at workplace	00	00	30
Module 6: Develop Advance Computer Application Skills **Aim:**	**LU1:** Manage Information System to complete a task **LU2:** Prepare Presentation using computers **LU3:** Use Microsoft Access to manage database **LU4:** Develop graphics for Design	00	00	40
Module 7: Manage Human Resource Services **Aim:**	**LU1:** Determine strategies for delivery of human resource services **LU2:** Manage the delivery of human resource services **LU3:** Evaluate human resource service delivery **LU4:** Manage integration of business ethics in human resource practices	00	00	20
Module 8: Develop Entrepreneurial Skills **Aim:**	**LU1:** Develop a business plan **LU2:** Collect information regarding funding sources **LU3:** Develop a marketing plan **LU4:** Develop basic business communication skills	00	00	30

INDUSTRIAL AUTOMATION

Module-1

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

Modules

Module 1: 071400940 Configure AC Drives and Motors

Objective of the module: The aim of this module to get knowledge, skills and understanding to configure ac drives and motors

Duration: 250 hours **Theory:** 50 hours **Practical:** 200 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Operate AC Drives and Motors	**The trainee will be able to:** 1. Select tools, motors and drives as per requirement 2. Perform wiring of motor, drives and controllers as per requirement 3. Set parameters of drives and controller as per requirement 4. Troubleshoot motor and drives	Understanding of various tools to be used for AC Drives and Motors. Introduction to the basic principles of single phase and three phase induction motors. Introduction to basic principle of servo motors. Basic concept of wiring of VFD and servo drive. Understanding the basics of speed control of AC Motors. • Parameters setting of VFD • Parameters setting of servo drive • Understanding and identification of different errors in AC drives. • Identification of different faults in AC motors.	**Total** 130hrs **Theory:** 30 hrs **Practical:** 100 hrs	Consumable • White board • Notebooks • Pencils • Erasers • Thimbles • Tags Non Consumable • White board • Sharpeners • Multimedia • Computer system with Internet • VFD and induction motor • Servo Drive and servo motor	Class room / Lab / Workshop

				• Wire, cable and accessories • Connectors	
LU2: Integrate AC Drives with PLC	**The trainee will be able to:** 1. Identify communication protocols of drives and controllers as per requirement 2. Control Servo Operation using PLC as per requirement 3. Control Variable Frequency Drive (VFD) operation using PLC as per requirement 4. Interface encoders with PLC and drives as per requirement **5.** Troubleshoot drives communication	Basic knowledge of the protocol to be used for communication of AC drives with PLC. Configure the PLC Communication for AC drives. Understand working of rotary encoders and their interfacing with PLC. Knowledge of different accessories (connectors, cables, cable assemblies, and cord sets) used for encoder integration with controller. • Speed, direction and torque control of induction motor using external terminals and PLC. • Speed, direction, position and torque control of servo motor using PLC. • Online parameter setting using servo control software • Understanding and identification of different communication faults, their causes and possible solution in AC Drives.	**Total** 120 hrs **Theory:** 20 hrs **Practical:** 100 hrs	Consumable • White board • Notebooks • Pencils • Erasers Non Consumable • White board • Sharpeners • Multimedia • Computer system with Internet • Servo Drive Trainer • VFD Trainer • PLC Trainer • HMI Trainer • Encoders • Communication Cables and accessories • Communication	Class room / Lab / Workshop

				mediums • Power Supply • PC	

INDUSTRIAL AUTOMATION

Module-2

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

Module 2: 071400941 Operate Industrial Robot

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

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Install industrial robot	**The trainee will be able to:** 1. Select tools & accessories as per requirement 2. Connect cables and peripheral as per requirement 3. Integrate pneumatic / hydraulic system with robot as per requirement 4. Take safety measures as per requirement	Understanding the manufacturer's instructions as per the installation manual including unpacking, mechanical assembly, electrical connections, software installation and communication establishment. Assembling the robot, following the installation instructions provided by the manufacturer, including proper connections of the cables and peripherals (i.e. computers, teach-pendant, etc.). Installing the operating software on the computer with proper connections with the hardware of the robot. Calibrating the sensors before the first run of the robot. Understanding the connections of pneumatic/hydraulic units with the robot through standard solenoid operated valve modules. Understanding the component-level checking of the installed modules and peripherals. Operational knowledge of the first dry run of the robot including the homing operation, reaching to a specific position, etc.	**Total** 30 **Theory:** 6 **Practical:** 24	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet • 6 DOF Robotic manipulator with all the peripherals including the gripper • Pneumatic/ hydraulic power unit	Robotics Lab

				with solenoid valves	
LU2: Develop programs for robotic applications	**The trainee will be able to:** 1. Develop program using Teach Pendant (online) 2. Simulate Robot Program as per requirement. 3. Develop program using Robots Software (offline)	Understanding the programming of the robot by adding different positions using the teach-pendant. Understanding the robot movements using the controls available on the teach-pendant both in joint-space and task-space. Configuring the robot in its programming software and then programming the robot by adding different positions using the software. Writing a basic set of movement commands in the robot's programming software and then simulating the response of the robot. Understanding the physical movement of robot using the options available in the programming software (both in joint-space and task-space) Study the concepts of robot configuration, work envelop, task-space and joint-space. Programming the robot to perform different tasks in different settings such as: • Robot-gripper movement along cartesian axis, under different speed settings • Pick and place exercise • Pick and place exercise with waypoints • Pick and place activity with obstacle avoidance	**Total** 72 **Theory:** 12 **Practical:** 60	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet • 6 DOF Robotic manipulator with all the peripherals including the gripper • Pneumatic/ hydraulic power unit with solenoid valves • Components for robotic	Robotics Lab

		• Basic assembly operation with linear movements • Assembly operation with linear traverse and twist • Dis-assembly operation		assembly and pick-and-place exercises	
LU3: Troubleshoot / Debug Robot	**The trainee will be able to:** 1. Select Tools as per requirement 2. Edit and debug a program using Teach Pendant /Software 3. Troubleshoot Control Panel and Drives	Understanding the different error-codes (most frequently occurring) of the robot and their corresponding causes. Understanding the maintenance manual of the robot with strong emphasis to preventive maintenance practices. Troubleshooting the hardware-related faults including, but not limited to, hardware-connection faults, communication errors, sensor noise/disconnection, limit sensing, etc. Troubleshooting the software-related faults such as faulty program-sequence, syntax errors, etc. Isolating and debugging the programs in robot-alone settings. Isolating and debugging the programs in robot-with-peripheral settings. Troubleshooting the drive interfaces with the robot. Troubleshooting the robot-program in simulation mode to fulfill all the task requirements.	**Total** 38 **Theory:** 10 **Practical:** 28	Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet • 6 DOF Robotic manipulator with all the peripherals including the gripper • Pneumatic/ hydraulic power unit with solenoid valves	Robotics lab

				• Components for robotic assembly and pick-and-place exercises	

INDUSTRIAL AUTOMATION

Module-3

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

Module 3: Contribute to Work Related Health and Safety (WHS) Initiatives

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: Contribute to initiate work-related health and safety measures	**The trainee will be able to:** 1. Compile database on work-related health and safety 2. Identify measures that address legal obligations. 3. Consult with individuals/ parties to formulate measures and initiatives 4. Consult with individuals/parties to identify factors impacting on work-related health and safety 5. Participate in consultative meetings.		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room
LU2: Contribute	**The trainee will be able**		**Total**	Non Consumable	Class room

to establish work-related health and safety measures Safety framework	**to:** 1. Assist in planning of work-related health and safety measures 2. Contribute to the development of work-related health and safety measures 3. Identify to implement work-related health and safety measures i.e. • resourcing requirements, • timelines • responsibilities 4. Assist to implement work-related health and safety measures and initiatives i.e. • scheduling • liaison • administering resources • communication		**Theory:** **Practical:**	• Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	

LU3: Contribute to ensure legal requirements of WHS measures awareness training program	**The trainee will be able to:** 1. Identify WHS legal requirements 2. Apply knowledge of all aspects of WHS measures to • Consultation • workplace policies • participation processes 3. Ensure, WHS measures are in accordance with legal requirements		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room
LU4: Contribute to review WHS measures	**The trainee will be able to:** 1. Develop effective practices to review work-related health and safety measures 2. Assist individuals and parties related to WHS measures in following activities • preparing reports • communicating		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

	review **3.** evaluating outcomes				
LU5: Evaluate the organization's WHS system	**The trainee will be able to:** 1. Assess ongoing compliance with OHS (Occupational Health and safety) 2. Take feedback from concerned persons regarding WHS measures. 3. Assess the overall effectiveness of WHS management practices 4. Assist the development process of WHS measures in following ways • Suggest amendments • Document amendments • Implement amendments 5. Take feedback from			Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

	concerned persons regarding WHS measures. **6.** Communicate improvements in WHS Measures				

INDUSTRIAL AUTOMATION

Module-4

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

Module 4: Comply with Workplace Policy and Procedures

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

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Manage work timeframes	**The trainee will be able to:** 1. Complete work tasks within deadlines in according to order of priority 2. Supervisors are informed of any delays in work times or projects		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room
LU2: Manage to convene meeting	**The trainee will be able to:** 1. Develop agenda in line with meeting purpose 2. Select participants and notify them accordingly 3. Carryout meeting		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer	Class room

	arrangements according to the time 4. Record the minutes of the meeting			system with Internet	
LU3: Decision making at workplace	**The trainee will be able to:**		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room
LU4: Set and meet own work priorities at instant	**The trainee will be able to:** 1. Take initiative to prioritize and facilitate competing demands to achieve organizational goals and objectives 2. Use technology efficiently and			Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with	Class room

	effectively to manage work priorities and commitments **3.** Maintain appropriate work-life balance			Internet	
LU5: Develop and maintain professional competence	**The trainee will be able to:** 1. Assess personal knowledge and skills against competency 2. Participate in networks to enhance personal knowledge, skills and work relationships 3. Seek feedback from employees, clients and colleagues to develop and improve competence			Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room
LU6: Follow and implement work safety requirements	**The trainee will be able to:** 1. Identify and report emergency incidents 2. Practice organizational policy			Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable	Class room

	and procedures for responding to emergency incidents **3.** Identify and implement workplace procedures and work instructions for controlling risks			• White board • Multimedia • Computer system with Internet	

INDUSTRIAL AUTOMATION

Module-5

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

Module 5: Perform Advance Communication

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

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

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Demonstrate professional skills	**The trainee will be able to:** 1. Use different modes of communication to communicate • Speaking • Reading • Writing • Listening • Presentation • visual representation etc 2. Develop CV Skills according requirements 3. Upgrade professional skills by attending trainings, webinars, conferences etc. 4. Perform Continuous professional development as required at workplace 5. Develop interview skills		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

LU2: Plan and Organize work	**The trainee will be able to:** 1. Identify task requirements. 2. Plan steps to complete tasks. 3. Review planning and organizing process. **4.** Organize work		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room
LU3: Provide trainings at workplace	**The trainee will be able to:** 1. Assess the need for training 2. Prepare trainees for the learning experience 3. Present training session 4. Support trainees in managing their own learning 5. Facilitate group learning 6. Provide opportunity for practice 7. Provide feedback on progress on trainees 8. Review delivery experience		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

INDUSTRIAL AUTOMATION

Module-6

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

Module 6: Develop Advance 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: Manage Information System to complete a task	**The trainee will be able to:** 1. Perform Data Entry in MS office 2. Manage File/folder in MS office 3. Perform Scanning of document 4. Maintain Office Record in drives 5. Perform Printing of document 6. Search required Files/Folders 7. Convert Files in required format. 8. Manage sizes of Files/Folders • Compress • Zip /unzip		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

LU2: Prepare Presentation using computers	**The trainee will be able to:** 1. Prepare presentation as per requirements, i.e. 2. Open blank presentation and add text / graphics 3. Create a simple design for a presentation 4. Apply existing styles within a presentation 5. Use presentation template and slides to create a presentation 6. Use various tools to improve the look of the presentation 7. Save presentation to the appropriate storage device and folder with required name 8. Customize basic		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

	settings to meet user requirements 9. Format presentation as require • Develop organizational charts • Add objects and manipulate to meet presentation purposes • Modify slide layout, including text and colours, to meet presentation requirements • Save presentation in another format • Save to storage device and close presentation 10. Add slide show effect into presentation as				

	required to enhance the presentation • Incorporate pre-set Animation • Apply Multimedia effects • Record Narration • Apply hyperlink • Apply video • Rehearse Timings • Test presentation for overall effect 11. Print the presentation • Select appropriate print format for presentation • Select preferred slide orientation • Add notes and slide numbers • Preview slides				

	and run spell check before presentation • Print selected slides and submit presentation to appropriate person for feedback 12. Practice verbal presentation 13. Practice presentation through AV Aids				
LU3: Use Microsoft Access to manage database	**The trainee will be able to:** 1. Collect the data using a standard data base package. 2. Start access to manage database .i.e. • identify problem statement of Data • Develop a table		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

	with fields /attributes according to database usage/ user requirements • Create a primary key and establish an index for each table • Modify table layout and field attributes as required • Create a relationship between the two tables • Add data in a table according to information requirements • Add records as required • delete records				

	as required • Save database to storage area • close down database to storage area • Apply criteria in the following Query • SQL view of Query • Wildcards of query • Query Criteria 3. Customize basic settings: • Adjust page layout to meet user requirements • Open and view different toolbars • Format font as appropriate for the purpose of the database				

	entries • Create reports • Design reports to present data in a logical sequence • Modify reports to include or exclude additional requirements • Distribute reports to appropriate person in a suitable format 4. Create forms • Use a wizard to create a simple form • Open existing database and modify records through a simple form 5. Rearrange objects				

	within the form to accommodate information requirements				
LU4: Develop graphics for Design	**The trainee will be able to:** 6. Develop graphic design concepts based on a thorough understanding of the communication need 7. Use design techniques confidently to produce designs 8. Integrate design tools skillfully to produce designs 9. Evaluate the success of completed designs to meet objectives 10. evaluate feedback from client / peers		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

INDUSTRIAL AUTOMATION

Module-7

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

Module 7: Manage Human Resource Services

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: Determine strategies for delivery of human resource services	**The trainee will be able to:** 1. Analyze business strategy and operational plans to determine human resource requirements 2. Review external business environment that likely impact on organization's human resource requirements 3. Consult line and senior managers to identify human resource needs in their areas 4. Review organization's requirements for diversity in the workforce 5. Deliver human resource services that comply with business goals		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

	6. Develop strategic action plan for delivery of human resource services 7. Develop roles and responsibilities of human resource team • Develop quality assurance policy				
LU2: Manage the delivery of human resource services	**The trainee will be able to:** 1. Communicate human resource strategies and services to internal and external stakeholders 2. Develop and negotiate service agreements between • The human resource team, • Service providers • Client groups 3. Document service specifications, performance standards and timeframes 4. Document /communicate service		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

	• Specifications, • Performance standards • Timeframes 5. Monitor Quality assurance processes 6. Ensure that services are delivered by appropriate providers, according to service agreements and operational plans 7. Identify underperformance of human resource team or service providers				
LU3: Evaluate human resource service delivery	**The trainee will be able to:** 1. Establish Management information system for human resource services 2. Conduct survey to determine level of satisfaction 3. Analyze feedback of survey		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with	Class room

	4. Recommend changes to service delivery 5. Support agreed change processes across the organization			Internet	
LU4: Manage integration of business ethics in human resource practices	**The trainee will be able to:** 1. Ensure ethics in personal behavior 2. Ensure code of conduct is observed across the organization, 3. Observe confidentiality requirements in dealing with all human resource information 4. Deal promptly with unethical behavior 5. Ensure all persons responsible for human resource functions understand requirements regarding their ethical behavior		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

INDUSTRIAL AUTOMATION

Module-8

CBT CURRICULUM

National Vocational Certificate Level 4

Version 1 - July, 2019

Module 8: Develop Entrepreneurial Skills

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 business plan	**The trainee will be able to:** 1. Conduct a market survey to collect following information • Customer /demand • Tools, equipment, machinery and furniture with rates • Raw material • Supplier • Credit / funding sources • Marketing strategy • Market trends • Overall		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

	expenses • Profit margin 2. Select the best option in terms of cost, service, quality, sales, profit margin, overall expenses 3. Compile the information collected through the market survey, in the business plan format				
LU2: Collect information regarding funding sources	**The trainee will be able to:** 1. Identify the available funding sources based on their terms and conditions, maximum loan limit, payback time, interest rate 2. Choose the best available option according to investment requirement 3. Prepare documents according to the loan		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room

	agreement requirement 4. Include the information of funding sources in the business plan				
LU3: Develop a marketing plan	**The trainee will be able to:** 1. Make a marketing plan for the business including product, price, placement, promotion, people, packaging and positioning 2. Include the information of marketing plan in the business plan		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable • White board • Multimedia • Computer system with Internet	Class room
LU4: Develop basic business communication skills	**The trainee will be able to:** 1. Communicate with internal customers e.g.: labor, partners and external		**Total** **Theory:** **Practical:**	Non Consumable • Notebooks • Pencils • Erasers • Sharpeners Non Consumable	Class room

	customers e.g.: suppliers, customers etc., using effective communication skills 2. Use different modes of communication to communicate internally and externally e.g.: presentation, speaking, writing, listening, visual representation, reading etc. 3. Use specific business terms used in the market			• White board • Multimedia • Computer system with Internet	

General assessment guidance for *"Industrial Automation Level-4"*

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 connecting the break release circuit with robot
- Work Performances, for example interfacing of Pneumatic and Hydraulic Components with Robots.
- Demonstrations, for example Induction motor speed/direction and torque control using VFD; Servo motor speed/direction/position/torque control using Servo drive.

- 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 8 modules:

- Module 1: Configure Ac Drives and Motors
- Module 2: Operate Industrial Robot
- Module 3: Contribute to Work Related Health and Safety (WHS) Initiatives
- Module 4: Analysis Workplace Policy and Procedures
- Module 5: Perform Advanced Communication
- Module 6: Develop Advance Computer Application Skills
- Module 7: Manage Human Resource Services
- Module 8: Develop Entrepreneurial Skills

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 at least one hour min 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 half short-answer questions. This part shall cover the technical, functional and generic modules:

For Level -4

- Module 1: Configure Ac Drives and Motors
- Module 2: Operate Industrial Robot
- Module 3: Contribute to Work Related Health and Safety (WHS) Initiatives
- Module 4: Analysis Workplace Policy and Procedures
- Module 5: Perform Advanced Communication
- Module 6: Develop Advance Computer Application Skills
- Module 7: Manage Human Resource Services
- Module 8: Develop Entrepreneurial Skills

For the final practical assessment of Level -4 assessments, each student shall be assessed over a period of two days, with Four hour sessions on each day. 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 4: Analysis Workplace Policy and Procedures, Module 5: Perform Advanced Communication not be assessed separately, but must be assessed during practical sessions.

There is no final practical assessment for Module 3: Contribute to Work Related Health and Safety (WHS) Initiatives, Module 6: Develop Advance Computer Application Skills, Module 7: Manage Human Resource Services, Module 8: Develop Entrepreneurial Skills .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.	DMM (Digital Multi meter Clamp Type)	20
11.	PLC and HMI Trainer (Siemens, Mitsubishi, Allen Bradley, Fatek, Delta, ABB) 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: Digital I/Os Components: 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 Contactors Analogue I/Os Components: 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	10

	20 mA)	
12.	Servo Trainer: Servo Motor and Drives with Brake (400 W) with Interface Cable, Connector and Accessories, Multi Turn Variable, Manual Pulse Generator (MPG), External variable Brake	5
13.	VFD Trainer: Induction Motor and VFD (1.5 KW) with Interface Cable and Encoder Feedback Module (ABZ Differential 5V), Connector and Accessories, Multi Turn Variable, Encoder 1024 PPR (ABZ Differential 5V)	5
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	2
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,	2
16.	Industrial Robot (6DOF) with all accessories; Industrial Robotic Manipulator 6 DOF, 1.5-3kg payload capacity, Maximum reach (stretched arm) ~900mm, complete setup with controller, teach pendent, programming software, pneumatic/hydraulic gripper and all the standard accessories and peripherals.	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)	20
50.	Terminal Blocks	500
51.	Cable lugs (U , I & O Type) 1mm, 1.5 mm, 4mm	20 Packet Each
52.	Cable Tie (Small & Medium)	200 Packet Each
53.	Air Blower	1
54.	Slotted Trunking 25mm X 45mm-(2Meter Length)	10
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.	Allen key set (mm size)	20
60.	Allen key set (inch size)	20
61.	Sockets set	2
62.	Electrical tool kit	10
63.	Magnetic contactor (220 VAC)	10
64.	Timer relay (220 VAC)	10

65.	Overload relays	10
66.	Under voltage relay	10
67.	Three phase AC motors	05
68.	Single phase AC motors	05
69.	Variable power supply	05
70.	Memory devices	10
71.	Analog multi- meter	05
72.	Analog sensor module	05
73.	Hydraulic boards	05
74.	Pneumatic boards	05
75.	Multimedia	01
76.	White board	01

List of Consumable Supplies

1. Label (Tags - Alphabetically & Number wise)
2. Note books
3. Pen
4. Pencils
5. Sharpeners
6. Erasers
7. White board markers(Different colors)
8. A4 papers
9. Batteries and Cells
10. Internet
11. Control Wires
12. Thimble
13. Hydraulic Oil
14. Instrument Air
15. Oil

Credit values

The credit value of the National Certificate Level-4 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: Configure AC Drives and Motors	350	35
B: Operate Industrial Robot	200	20
C: Contribute to Work Related Health and Safety (WHS) Initiatives	30	3
D: Analysis Workplace Policy and Procedures	30	3
E: Perform Advanced Communication	30	3
F: Develop Advance Computer Application Skills	40	4
G: Manage Human Resource Services	20	2
H: Develop Entrepreneurial Skills	30	3

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