

CURRICULUM OF “INTERNET OF THINGS”

Dec 2021



**National Vocational & Technical
Training Commission**

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Introduction

Definition/ Description of the training programme for *Internet of Thing*

The Internet of Things (IoT) is a network of resource constrained nodes being capable of automating an existing manual procedure.

Purpose of the training programme

The IoT programme is to engage young people with a programme of development that will provide them with the knowledge, skills and understanding to start this career in Pakistan. The specific objectives of developing these qualifications are as under:

- Improve the professional competence of the trainees
- Provide opportunities for recognition of skills attained through non-formal or informal pathways
- Improve the quality and effectiveness of training and assessment for IoT industry

Overall objectives of training programme

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

- Cloud administrator
- Mobile app developer
- IoT security associate

Competencies to be gained after completion of course

- Interface long range wireless technologies (LoRa, NB IoT, MTC) with Micro-controller
- Apply MQTT, CoAP, HTTP on IoT nodes
- Configure IoT gateways (Wi-Fi/LoRa/NB-IoT)
- Install/Configure Android Studio
- Build mobile application
- Build robust UI for greater UX (user experience)
- Test, debug and use support libraries
- Program/use background applications
- Save user data/Integrate android application with database
- Set up cloud sever
- Develop program in Python
- Deploy hardware protection
- Perform software security
- Implement cryptography and network security
- Manage and Supervise the Job Activities
- Develop entrepreneurial Skills
- Create/Manage profile on Freelancing Platform
- Write professional proposals for freelance projects
- Practice professionalism

Trainee entry level

The entry requirement for this qualification would be Matric with science with level 4 certificate of IoT. Age 18 years or above

Minimum qualification of trainer

Teaching staff qualification should be BS (EE) with specialization in computer, BS (Computer Engineering, Computer Science, Software Engineering, I.T, Computer Networks, Cyber security, Data Science, and IOT) or equivalent.

Recommended trainer: trainee ratio

The recommended maximum trainer: trainee ratio for this programme is 1 trainer for 25 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 19 module. The recommended delivery time is 1200 hours. Delivery of the course could therefore be full time, 5 days a week, for 12 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 Level-5	Theory¹ Days/hours	Workplace² Days/hours	Total hours
Module 1 Interface long range wireless technologies (LoRa, NB IoT, MTC) with Micro-controller	22	24	46
Module 2 Apply MQTT, CoAP, HTTP on IoT nodes	15	18	33
Module 3 Configure IoT gateways (Wi-Fi/LoRa/NB-IoT)	23	27	50
Module 4 Install/Configure Android Studio	19	27	46
Module 5 Build mobile application	25	57	82
Module 6 Build robust UI for greater UX (user experience)	19	27	46
Module 7 Test, debug and use support libraries	22	30	52
Module 8 Program/use background applications	33	45	78
Module 9 Save user data/Integrate android application with database	29	51	80
Module 10 Set up cloud sever	29	51	80
Module 11 Develop program in Python	19	33	52
Module 12 Deploy hardware protection	15	45	60
Module 13 Perform software security	19	18	37
Module 14 Implement cryptography and network security	18	42	60
Module 15 Manage and Supervise the Job Activities	20	12	32
Module 16 Develop entrepreneurial Skills	20	12	32

Module 17 Create/Manage profile on Freelancing Platform	10	15	25
Module 18 Write professional proposals for freelance projects	10	6	16
Module 19 Practice professionalism	100	200	300

¹ Learning Module hours in training provider premises

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

Summary – overview of the curriculum

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 1 : Identify and interface long range wireless technologies (Lora, NB IoT, MTC) with Microcontroller Aim: The aim of this module to develop advanced knowledge, skills and understanding to Set up Cloud Sever	LU1. Use LoRa with Micro-controller LU2. Use NB IoT with Micro-controller LU3. Identify and use MTC (Cellular 4G networks)	22	24	46
Module 2 : Apply MQTT, CoAP, HTTP on IoT nodes Aim: The aim of this module to develop advanced knowledge, skills and understanding to apply MQTT, CoAP, HTTP on IoT nodes	LU1. Apply MQTT on IoT nodes LU2. Apply CoAP on IoT nodes LU3. Apply HTTP on IoT nodes	15	18	33

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 3 : Configure IoT gateways (Wi-Fi/LoRa/NB-IoT) Aim: The aim of this module to develop advanced knowledge, skills and understanding to Configure IoT gateways (Wi-Fi/LoRa/NB-IoT)	LU1. Configure WiFi-IoT gateways LU2. Configure LoRa Gateway LU3. Configure NB-IoT Gateway	23	27	50
Module 4 : Install/ Configure Android Studio Aim: The aim of this module to develop advanced knowledge, skills and understanding to Install/ Configure Android Studio	LU1. Build XML Application LU2. Install /Configure Android Studio	19	27	46
Module 5 : Build Mobile Application Aim: The aim of this module to develop advanced knowledge, skills and understanding to build mobile application	LU1. Build Application using different layouts and UI Components LU2. Handle Intents LU3. Create service LU4. Configure Gradle	25	57	82

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 6 : Build robust UI for greater UX (user experience) Aim: The aim of this module to develop advanced knowledge, skills and understanding to Build robust UI for greater UX (user experience)	LU1. Use controls LU2. Make Robust UX	19	27	46
Module 7 : Test, Debug and use support libraries Aim: The aim of this module to develop advanced knowledge, skills and understanding to test, debug and use support libraries	LU1. Test Application using Junit LU2. Make Application for backward compatible	22	30	52
Module 8 : Program/use background applications Aim: The aim of this module to develop advanced knowledge, skills and understanding to Program /use background applications	LU1. Run background tasks LU2. Authorize/ Use APIs in code LU3. Manage notifications	33	45	78

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 9 : Save user data/Integrate android application with database Aim: The aim of this module to develop advanced knowledge, skills and understanding to save user data/Integrate android application with database	LU1. Manipulate data using SharedPreferences LU2. Manipulate data using File I/O LU3. Manipulate data in SQLite/Room LU4. Manipulate data using online databases	29	51	80
Module 10 : Set up Cloud Sever Aim: The aim of this module to develop advanced knowledge, skills and understanding to set up cloud sever	LU1. Select a Cloud Service Provider LU2. Configure Virtual Machines LU3. Configure Virtual Network LU4. Perform Basic Security LU5. Perform Cloud Computation LU6. Perform Cloud Networking LU7. Create backup and restore virtual machine LU8. Deploy Provisioning and Management	29	51	80
Module 11 : Develop Program in Python Aim: The aim of this module to develop advanced knowledge, skills and understanding to develop program in Python	LU1. Develop Basic programing concepts in Python LU2. Develop programs using basic classes	19	33	52

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 12 : Deploy hardware protection Aim: The aim of this module to develop advanced knowledge, skills and understanding to deploy hardware protection	LU1. Set Up a Basic Firewall LU2. Protect IoT gateway from Wifi Attacks LU3. Secure device to device / end to end communication	15	45	60
Module 13 : Perform software security Aim: The aim of this module to develop advanced knowledge, skills and understanding to Perform software security	LU1. Apply Secure Service Layer(SSL) in your client server applications LU2. Secure MQTT with Encryption and Decryption	19	18	37
Module 14 : Implement cryptography and network security Aim: The aim of this module to develop advanced knowledge, skills and understanding to Implement cryptography and network security	LU1. Set up anaconda environment for security LU2. Implement Cryptography library in Anaconda environment LU3. Implement Hash Function in Anaconda environment	18	42	60

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 15 : Manage and Supervise the Job Activities Aim: The aim of this module to develop advanced knowledge, skills to manage and supervise the job activities.	LU1. Plan for on-site operations LU2. Supervise work activities to achieve desired results LU3. Perform on- site inspection LU4. Prepare the inspection report.	20	12	32
Module 16 : Develop entrepreneurial skills Aim: The aim of this module to develop advanced knowledge, skills to Develop entrepreneurial skills	LU1. Develop a business plan LU2. Collect information regarding funding resources LU3. Develop a marketing plan LU4. Develop basic business communication skills	20	12	32
Module 17 : Practice Professionalism Aim: The aim of this module to develop advanced knowledge, skills to Develop entrepreneurial skills	LU1. Develop Portfolio for industry LU2. Perform Internship	10	15	25

Module Title and Aim	Learning Units	Theory Days/hours	Workplace Days/hours	Timeframe of modules
Module 18 : Create Manage profile on Non-Traditional Freelancing platform Aim: The aim of this module to develop skills to Create Manage profile on Non-Traditional Freelancing platform	LU1. Recognize Gig Economy LU2. Setup Profile LU3. Create the Gigs LU4. Provide High Quality Services as a seller. LU5. Develop/Increase Business	10	6	16
Module 19 : Write proposal for projects Aim: The aim of this module to develop skills to Write professional proposal for projects	LU1. Write a winning proposal LU2. Adopt best practices of proposal writing	100	200	300

Modules

Module 1 : Interface Long Range Wireless Technologies (LoRa, NB IoT, MTC) with Micro-Controller

Objective of the module: This competency unit covers the skills and required knowledge to use different Short-Range Wireless Technologies such as (LoRa, NB IoT, MTC). This competency unit also covers the tools required to execute the performance criterion.

Duration:	46 hours	Theory:	22 hours	Practical:	24 hours
Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Use LoRa with Micro-controller	Trainee will be able to: <ul style="list-style-type: none"> Download datasheet Select pin configuration and interfacing protocol Install the required library on IDE Configure LoRa settings Establish LoRa communication between two different modules Transmit and receive application data Rectify the issues in connectivity of the device 	<ul style="list-style-type: none"> Knowledge of downloading and examine datasheet of LoRa and Micro-controllers. Knowledge to configure the pins and interface protocols Download and install required library on IDE Configure and Customize connectivity setting Perform data transmission and data reception Identification of communication errors Practical Activity: <ul style="list-style-type: none"> Practice to interface LoRa with Arduino wirelessly and verify its working using mobile app. 	Total: 12 hrs Theory: 06 hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpener Non Consumable <ul style="list-style-type: none"> Temperature Sensor Internet Computer Multimedia projector Instructional manual Wifi module 	Classroom Computer lab

				<ul style="list-style-type: none"> Raspberry Pi Controller IoT Device 	
LU2: Use NB IoT with Micro-controller	Trainee will be able to: <ul style="list-style-type: none"> Select pin configuration and communication interface from datasheet Setup NB-IoT and access point Open a UDP socket in another compatible mobile Transmit and receive application data Rectify the issues in connectivity of the device 	<ul style="list-style-type: none"> Knowledge of downloading and examine datasheet of NB IoT and Micro-controllers. Knowledge to configure the pins and interface protocols Download and install required library on IDE Configure and Customize connectivity setting Perform data transmission and data reception Practical Activity: <ul style="list-style-type: none"> Practice to interface NB-IoT with Arduino wirelessly and verify its working using mobile app. 	Total 17 hrs Theory: 08 hrs Practical: 09 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpener Non Consumable <ul style="list-style-type: none"> White board Multimedia Internet Computer system Bluetooth module IoT Device 	Classroom Computer lab
LU3: Use MTC (Cellular 4G networks)	Trainee will be able to: <ul style="list-style-type: none"> Make hardware connections of the LTE module with Raspberry Pi Install any required software and configure settings Setup network interface 	<ul style="list-style-type: none"> Knowledge of downloading and examine datasheet of MCT equipment (LTE Modules) and Micro-controllers. Knowledge to configure the pins and interface protocols Download and install required library on IDE 	Total 17 hrs Theory: 08 hrs Practical:	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpener 	Classroom Computer lab

	<ul style="list-style-type: none"> • Establish communication between two different modules • Transmit and receive application data • Rectify the issues in connectivity of the device 	<ul style="list-style-type: none"> • Configure and Customize connectivity setting • Perform data transmission and data reception <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to receive data from a machine (heater) using sensor 	09 hrs	Non Consumable <ul style="list-style-type: none"> • Internet • Computer • Multimedia projector • Instructional manual • BLE module • Raspberry Pi Controller • IoT Device 	
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Module 2 : Apply MQTT, CoAP, HTTP on IoT nodes

Objective of the module: This competency unit covers the skills and required knowledge to use different Long-Range Wireless Technologies such as LoRa, NB IoT and MTC. This competency unit also covers the tools required to execute the performance criterion.

Duration:	33 hours	Theory:	15 hours	Practical:	18 hours
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Apply MQTT, on IoT nodes	Trainee will be able to: <ul style="list-style-type: none"> Establish MQTT Client Establish MQTT broker Use MQTT built-in libraries for MQTT communication in application codes. Send and receive data using publish subscribe paradigm 	<ul style="list-style-type: none"> Define network Protocol Explain transportation of messages between devices Explain Message Queuing Telemetry Transport (MQTT) protocol MQTT devices, security, message size and default ports Knowledge of built-in libraries used for MQTT communication and configuration Test MQTT connectivity Practical Activity: <ul style="list-style-type: none"> Practice to configure MQTT Practice to send and receive messages to IoT devices using MQTT 	Total: 10 hrs Theory: 04 hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Non Consumable <ul style="list-style-type: none"> Internet Computer Multimedia projector Instructional manual NodeMCU Pi Controller IOT Devices 	Class room, Lab.

LU2: Apply CoAP on IoT nodes	Trainee will be able to: <ul style="list-style-type: none"> • Set up CoAP client • Set up CoAP server • Establish intercommunication of CoAP server with client 	<ul style="list-style-type: none"> • Define application layer protocol • Explain CoAP protocol and its communication process • CoAP devices, security, message size and default ports • Knowledge of built-in libraries used for CoAP communication and configuration • Test CoAP connectivity (server, client) • Differentiate different message types (Confirmable, Non-Confirmable, Acknowledgment, Reset) • Define message types used in CoAP Practical Activity: <ul style="list-style-type: none"> • Practice to configure CoAP • Practice to send and receive messages to IoT devices using CoAP 	Total 12 hrs Theory: 06 hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • Arduino • NodeMCU • Pi Controller • IOT Devices 	Class room, Lab.
LU3: Apply HTTP on IoT nodes	Trainee will be able to: <ul style="list-style-type: none"> • Use HTTP GET method to receive data • Use HTTP POST method to send data • Use HTTP CONNECT method for TCP connections 	<ul style="list-style-type: none"> • HTTP GET method to receive data • Practice HTTP POST method to send data • Practice HTTP CONNECT method to establish TCP session Practical Activity:	Total 11 hrs Theory: 05 hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable	Class room, Lab.

		<ul style="list-style-type: none"> Practice to send and receive messages to IoT devices using HTTP 		<ul style="list-style-type: none"> White board Multimedia Internet Computer system Arduino NodeMCU Pi Controller IOT Devices 	
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Module 3 : Configure IoT gateways (Wi-Fi/LoRa/NB-IoT)

Objective of the module: This competency unit covers the skills and required knowledge for the configuration of IoT gateways (Azure/LoRa/NB-IoT). This competency unit also covers the tools required to execute the performance criterion.

Duration:	50 hours	Theory:	23 hours	Practical:	27 hours
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Configure Wi-Fi-IoT gateways	Trainee will be able to: <ul style="list-style-type: none"> Set up a Raspberry Pi Install MQTT Broker Run a MQTT C client to read the data from broker. Run another MQTT client to send data to the MQTT broker on the cloud. Confirm data receipt on gateway from multiple end nodes 	<ul style="list-style-type: none"> Installation process of Raspberry Pi Install MQTT broker Techniques to deploy and execute MQTT C client to connect and get results from broker Configure gateway to receive data from multiple nodes Knowledge of basic directory structure Knowledge of basic configuration file Editing of basic configuration file according to requirements <p>Practical Activity:</p> <ul style="list-style-type: none"> Practice to run another MQTT client to send data to the MQTT broker on the cloud. 	Total: 15 hrs Theory: 09 hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Non Consumable <ul style="list-style-type: none"> Computer system Raspberry Pi Internet Multimedia projector UPS 	Class room, Lab.
LU2: Configure LoRa Gateway	Trainee will be able to: <ul style="list-style-type: none"> Run the configuration tool Select required parameters (channels etc.) 	<ul style="list-style-type: none"> Knowledge of downloading firmware for your module Knowledge of burning images of firmware (Etcher) to SD card 	Total 18 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils 	Class room, Lab.

	<ul style="list-style-type: none"> Test the configuration 	<ul style="list-style-type: none"> Knowledge of Wireless AP mode and SSID Knowledge of LoRa concentrator board, to receive LoRaWAN packets Connecting through Wifi and / or ethernet using ssh Configure LoRA gateway module Connect LoRA gateway to router Knowledge to Verify connectivity <p>Practical Activity:</p> <ul style="list-style-type: none"> Practice to configure LoRa Gateway Practice to test configuration 	<p>Theory: 09 hrs</p> <p>Practical: 09 hrs</p>	<ul style="list-style-type: none"> Erasers Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> White board Multimedia Internet Computer system LoRA module SD card Etcher software LoRA concentrator board Router 	
<p>LU3:</p> <p>Configure NB-IoT Gateway</p>	<p>Trainee will be able to:</p> <ul style="list-style-type: none"> Run the configuration tool Select required parameters (channels etc.) Test the configuration 	<ul style="list-style-type: none"> Define Narrow Band IoT and its application Execute software to configure module Configure required parameter (channels) Verify connectivity <p>Practical Activity:</p>	<p>Total: 17 hrs</p> <p>Theory: 05 hrs</p> <p>Practical: 12 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners <p>Non Consumable</p>	Class room, Lab.

		<ul style="list-style-type: none"> • Practice to configure NB IoT gateway • Practice to test configuration 		<ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system • NB-IoT modules 	
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Module 4 : Install/Configure Android Studio

Objective of the module: The aim of this module to get knowledge, skills and understanding to install/configure android studio.

Duration: 46 hours **Theory:** 19 hours **Practical:** 27 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Build XML Application	The trainee will be able to: <ul style="list-style-type: none"> Build XML (eXtensible Markup Language) Application Build XSLT/ Schema Build database in XML 	<ul style="list-style-type: none"> Understanding of XML Understanding of XML elements Understanding of XML Attributes Understanding of XML DOM Understanding of XSLT/Schema <p>Practical Activity</p> <ul style="list-style-type: none"> Practice to create database in XML Practice to create XML web page 	Total 21 hrs Theory: 09 hrs Practical: 12 hrs	<p>Consumable</p> <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpener <p>Non Consumable</p> <ul style="list-style-type: none"> Computer System Minimum 5th generation with 8 GB RAM and SSD Internet Connection Visual Studio code 	Class room, Computer Lab

LU2: Install/Configure Android Studio	The trainee will be able to: <ul style="list-style-type: none"> • Download any latest version of android studio • Install android studio • Download/Install required system Images for AVD • Configure Android Virtual Device (AVD) 	<ul style="list-style-type: none"> • Describe different versions and API levels of Android. • Explore and Describe Android API levels • Process to select best API level SDK for development • Understanding of Android virtual Device • Describe different screen sizes and resolutions • Explore Android Studio options <p>Practical Activity</p> <ul style="list-style-type: none"> • Practice to install and configure Android studio • Practice to run any AVD 	<p>Total: 25 hrs</p> <p>Theory: 10 hrs</p> <p>Practical: 15 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System <p>Minimum 5th generation with 8 GB RAM and SSD</p> <ul style="list-style-type: none"> • Android Studio 	<p>Class room, Computer Lab</p>
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Module 5 : Build Mobile Application

Objective of the module: The aim of this module to get knowledge, skills and understanding to build mobile application.

Duration: 82 hours **Theory:** 25 hours **Practical:** 57 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Build Application using different layouts and UI Components	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> Create new project Select best suitable API and language Add views in the Constraint Layout editor. Update the UI dynamically depending on user input Update Mobile application layout to perform well in portrait and landscape mode. Run application on emulator Write code in all lifecycle functions and observe the output 	<ul style="list-style-type: none"> Understanding of Activity Understanding of activity Lifecycle Knowledge of naming conventions for Application Will be able to determine what will be the minimum API level Knowledge of basic UI elements Learn how to add interactive UI elements to app and understand the range of UI elements available Knowledge to use Android Studio debugger <p>Practical Activity</p> <ul style="list-style-type: none"> Practice to build calculator mobile application using 2 types of Layouts Practice to write code in all lifecycle functions and observe the output 	<p>Total 23 hrs</p> <p>Theory: 08 hrs</p> <p>Practical: 15 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> White board Multimedia Internet Computer System Minimum 5th generation with 8 GB RAM and SSD Android Studio 	Class room, Computer Lab

	<ul style="list-style-type: none"> • Debug application using android studio debugger 	<ul style="list-style-type: none"> • Practice to run application on AVD • Practice to run application on mobile 			
LU2: Handle Intents	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> • Create new activities and start them by sending an explicit Intents. • Start a new activity by sending an implicit intent that looks for an activity to handle the request. 	<ul style="list-style-type: none"> • Knowledge of passing data in between activities • Types of intent <p>Practical Activity</p> <ul style="list-style-type: none"> • Practice to build application using two activities send some data from 1st to 2nd activity using intent • Practice to build an application with using 2 buttons. open a website by pressing button one and open phone dialer by pressing button two 	<p>Total 18 hrs</p> <p>Theory: 06 hrs</p> <p>Practical: 12 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System <p>Minimum 5th generation with 8 GB RAM and SSD</p> <p>Android Studio</p>	Class room, Computer Lab
LU3: Create service	<p>The trainee will be able to:</p>	<ul style="list-style-type: none"> • Understanding of running tasks in background 	<p>Total 20 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks 	

	<ul style="list-style-type: none"> • Create service in android studio • Transfer data between services and activities. 	<ul style="list-style-type: none"> • Understanding of services in OS • Importance and function of service in mobile application development • Concept of service lifecycle <p>Practical Activity</p> <ul style="list-style-type: none"> • Practice to build a service and show some text 	<p>Theory: 05 hrs</p> <p>Practical: 15 hrs</p>	<ul style="list-style-type: none"> • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System <p>Minimum 5th generation with 8 GB RAM and SSD</p> <p>Android Studio</p>	
LU4: Configure Gradle	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> • Select Gradle files • Add libraries • Build an Android app with free and paid product 	<ul style="list-style-type: none"> • Understanding functionality of Gradle • Knowledge of adding dependencies in Gradle • Explore the features of the Gradle Android plugin and build process. <p>Practical Activity</p>	<p>Total 21 hrs</p> <p>Theory: 06 hrs</p> <p>Practical: 15 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia 	Class room, Computer Lab

		<ul style="list-style-type: none"> Practice to build a simple application for free and paid products 		<ul style="list-style-type: none"> Internet Computer System Minimum 5th generation with 8 GB RAM and SSD Android Studio 	
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Module 6 : Build robust UI for greater UX (user experience)

Objective of the module: The aim of this module to get knowledge, skills and understanding to build robust UI for greater UX (user experience).

Duration: 46 hours

Theory: 19 hours

Practical: 27 Hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Use controls	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> Build activity and use image buttons, clickable images, input controls like switches, spinners (Drop down menu). Setup application bar and option menu in application. Use alert dialog and date picker. Add tabs to application 	<ul style="list-style-type: none"> Understanding of User Interface elements Knowledge of using the best suitable UI elements for the desired work <p>Practical Activity</p> <ul style="list-style-type: none"> Practice to create an application and design it using given requirement regarding controls 	<p>Total: 22 hrs</p> <p>Theory: 10 hrs</p> <p>Practical: 12 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> White board Multimedia Internet Computer System Minimum 5th generation with 8 GB RAM and SSD 	Class room , Computer Lab

				<ul style="list-style-type: none"> Android Studio 	
LU2: Make robust UX	The trainee will be able to: <ul style="list-style-type: none"> Add drawables, styles and themes to app Apply material design guidelines to lists and cards. Use material design colors. Use resource layout folders to allow app to work well in different orientations and screen sizes. Use Espresso, a mechanism for recording user interactions, to test app's user interface. 	<ul style="list-style-type: none"> Understanding of themes and styles Understanding of drawables Learn about material design, a visual design philosophy that allows apps to include material design attributes, such as depth and elevation. Knowledge of creating layouts that work well for different screen sizes and orientations, different devices, different locales and languages, and different Understanding of UI test using Espresso Practical Activity <ul style="list-style-type: none"> Practice to create an application and implement material design 	Total 24 hrs Theory: 09 hrs Practical: 15 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Non Consumable <ul style="list-style-type: none"> White board Multimedia Internet Computer System Minimum 5th generation with 8 GB RAM and SSD <ul style="list-style-type: none"> Android Studio 	Class room, Computer Lab

Module 7 : Test, Debug and use support libraries

Objective of the module: The aim of this module to get knowledge, skills and understanding to test, debug and use support libraries.

Duration: 52 hours

Theory: 22 hours

Practical: 30 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Test Application using Junit	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> • Create local unit testing using Junit • Build test cases • Run test 	<ul style="list-style-type: none"> • Understanding of Junit. • Knowledge of creating test and process to run it. <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to test an application on android studio using Junit 	<p>Total 22 hrs</p> <p>Theory: 11 hrs</p> <p>Practical: 15 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System Minimum 5th generation with 8 GB RAM and SSD • Android Studio 	Class room, Computer Lab

LU2: Make Application for backward compatible	The trainee will be able to: <ul style="list-style-type: none"> • Select Android support libraries • Use support libraries to get backward compatible version of new Android features 	<ul style="list-style-type: none"> • Knowledge of creating application compatible for previous versions of android by adding compatible dependencies. Practical Activity: <ul style="list-style-type: none"> • Practice to use support libraries to get backward compatible version of Android 	Total 22 hrs Theory: 11 hrs Practical: 15 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System Minimum 5th generation with 8 GB RAM and SSD <ul style="list-style-type: none"> • Android Studio 	Class room, Computer Lab
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Module 8 : Program/use background applications

Objective of the module: The aim of this module to get knowledge, skills and understanding to program/use background applications.

Duration: 78 hours **Theory:** 33 hours **Practical:** 45 Hours

Learning Unit	• Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Run background tasks	The trainee will be able to:	<ul style="list-style-type: none"> Understanding of managing background threads (like using AsyncTask/ java.util.concurrent) to run work in the background so that the user does not have to wait for the task to complete. Describe process to send, receive and respond to a system broadcast. Understanding to minimize battery drain. <p>Practical Activity:</p> <ul style="list-style-type: none"> Practice to use background using background task with timer 	<p>Total: 26 hrs</p> <p>Theory: 11 hrs</p> <p>Practical: 15 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> White board Multimedia Internet Computer System Minimum 5th generation with 8 GB RAM and SSD 	Class room , Computer Lab

	<ul style="list-style-type: none"> • Add background threads to run a task in the background. • Enable app to connect to the internet using a background task. • Update task keeps running if the user changes their device's orientation. • Responds to a system broadcast. • Send and receive a custom broadcast. • Use Job Scheduler to schedule tasks in a way that reduces battery drain. • Schedule and cancel an alarm. • Create code to integrate API 			<ul style="list-style-type: none"> • Android Studio 	
LU2: Authorize/ Use APIs in code	The trainee will be able to:	<ul style="list-style-type: none"> • Describe the functionality of 	Total	Consumable	Class room,

	<ul style="list-style-type: none"> • Authorize API • Use REST API • Use Google APIs 	<p>JSON.</p> <ul style="list-style-type: none"> • Knowledge of API authorization • Knowledge of retrieving data from REST APIs/Google APIs in JSON format. <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to authorize and use REST APIs 	<p>26 hrs</p> <p>Theory:</p> <p>11 hrs</p> <p>Practical:</p> <p>15 hrs</p>	<ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System Minimum 5th generation with 8 GB RAM and SSD • Android Studio 	Computer Lab
LU3: Manage notifications	The trainee will be able to:	<ul style="list-style-type: none"> • Understanding of Notifications • Understanding of time-sensitive notifications • Knowledge of generating group of notifications 	<p>Total:</p> <p>26 hrs</p> <p>Theory:</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers 	Class room, Computer Lab

	<ul style="list-style-type: none"> • Program to send a notification. • Program to update a notification. 	<ul style="list-style-type: none"> • Understanding of notification channels • Understanding of Importance level of notification • Knowledge of modifying notifications. <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to create a program to show notification 	11 hrs Practical: 15 hrs	<ul style="list-style-type: none"> • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System <p>Minimum 5th generation with 8 GB RAM and SSD</p> <p>Android Studio</p>	
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Module 9 : Save user data/Integrate android application with database

Objective of the module: The aim of this module to get knowledge, skills and understanding to save user data/Integrate android application with database.

Duration: 80 hours **Theory:** 29 hrs **Practical:** 51 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
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LU1: Manipulate data using SharedPreferences	The trainee will be able to: <ul style="list-style-type: none"> • Use SharedPreferences to save and retrieve user preferences. • Add a settings activity to an app to save the user's preferred app settings. 	<ul style="list-style-type: none"> • Describe the functionality of SharedPreferences Practical Activity: <ul style="list-style-type: none"> • Practice to make a program and store value in sharedPreferences and get stored value from sharedPreferences 	Total: 21 hrs Theory: 09 hrs Practical: 12 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System Minimum 5th generation with 8 GB RAM and SSD • Android Studio 	Class room , Computer Lab
LU2: Manipulate data using File I/O	The trainee will be able to:	<ul style="list-style-type: none"> • Understanding of file handling 	Total	Consumable <ul style="list-style-type: none"> • Notebooks 	Class room,

	<ul style="list-style-type: none"> • Build activity to store data in file • Add/update and delete data from file 	<ul style="list-style-type: none"> • Understanding file input stream. • Understanding of file output stream. <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to store data using file • Practice to read text from the file 	24 hrs Theory: 08 hrs Practical: 15 hrs	<ul style="list-style-type: none"> • Pencils • Erasers • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer System Minimum 5th generation with 8 GB RAM and SSD • Android Studio 	Computer Lab
LU3: Manipulate data in SQLite/ Room	The trainee will be able to:	<ul style="list-style-type: none"> • Understanding of database and its application. • Knowledge of SQLite database. 	Total 18 hrs Theory:	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers 	Class room, Computer Lab

	<ul style="list-style-type: none"> • Create database in SQLite database • Use Android's Room to save and retrieve data in the database. • Add / update and delete data 	<ul style="list-style-type: none"> • Understanding of database CRUD (Create, Read, Update, Delete) Operations • Understanding of Android Room Database. • Understanding of Android Room Database CRUD (Create, Read, Update, Delete) Operations <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to create a database and tables • Practice to insert some rows in table and display the store value on an activity 	06 hrs Practical: 12 hrs	<ul style="list-style-type: none"> • Sharpeners • Non Consumable • White board • Multimedia • Internet • Computer System • Minimum 5th generation with 8 GB RAM and SSD • Android Studio 	
LU4: Manipulate data using online databases	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> • Create online database (Like firebase) • Import libraries to connect with database • Store, update, retrieve and update data 	<ul style="list-style-type: none"> • Understanding of creating a Centralized Database • Knowledge of connecting Centralized Database with your Application by adding its dependencies • Understanding of database CRUD (Create, Read, 	Total 19 hrs Theory: 06 hrs Practical: 12 hrs	<ul style="list-style-type: none"> • Consumable • Notebooks • Pencils • Erasers • Sharpeners • Non Consumable 	Class room, Computer Lab

		<p>Update, Delete) Operations for Centralized Database.</p> <p>Practical Activity:</p> <ul style="list-style-type: none"> Practice to create database in firebase and use this database in mobile app 		<ul style="list-style-type: none"> White board Multimedia Internet Computer System Minimum 5th generation with 8 GB RAM and SSD Android Studio 	
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Module 10 : Set up Cloud Sever.

Objective of the module: The aim of this module is to covers the skills and required knowledge to set up cloud sever. The underpinning knowledge regarding computer operating systems and hardware will be sufficient to provide the basis for the job at workplace.

Duration:		80 hours	Theory:		29 hours	Practical:		51 hours
Learning Unit	Learning Outcomes	Learning Elements			Duration	Materials Required	Learning Place	
LU1: Select a Cloud Service Provider	The trainee will be able to: <ul style="list-style-type: none">Perform social engineering on cloud service provider and generate comparison reportEvaluate Technical capabilities and processes	<ul style="list-style-type: none">Introduction to different cloud standards i.e. FedRAMP, HITRUST etc.Introduction to cloud architecture by different cloud providers i.e. azure, amazon etc.Overview of different cloud server providersExplain Social Engineering and the steps involvedEnlist SDKs available on different Cloud servers i.e Amazon and AzureKnowledge of different cloud reference models.Investigate scalable architecture solutions for cloud PaaS.Basic knowledge of inter-operability and intra-operability.Explore portability and intra-operability of different cloud service providers. Practical Activity:			Total: 10 hrs	Consumable <ul style="list-style-type: none">NotebooksPencilsErasersSharpenersValid public cloud subscription Non Consumable <ul style="list-style-type: none">InternetComputer systemMultimedia	Classroom Lab	
					Theory: 04 hrs Practical: 06 hrs			

		<ul style="list-style-type: none"> Practice to enlist following considerations for selection of a cloud service provider for IoT system deployment Practice to browse Azure IoT Hub and enlist available solution and services Practice to browse Azure IoT central and enlist available solution and services 			
LU2: Configure Virtual Machines	The trainee will be able to: <ul style="list-style-type: none"> Set up cloud account Login to the subjected cloud Select the required Operating System for server Create the Virtual machine Configure accessibility using FTP/SSH Conduct test for verification of allocated resources 	<ul style="list-style-type: none"> Creating an account and login on a cloud server provider's dashboard. Knowledge of virtualization and virtual machines. Creating a Virtual Machine. Understanding of different configurations available on the dashboard Installing an OS on virtual machine. Define inbound and outbound rules to open ports for SSH and FTP. Understanding of command line interface Access the command line interface of cloud using SSH. Installing libraries (MQTT, OPENSSL, apache etc.) on the subjected virtual machine 	Total: 09 hrs Theory: 03 hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Valid public cloud subscription Non Consumable <ul style="list-style-type: none"> Internet Computer system Multimedia projector 	Classroom, Computer Lab

	<ul style="list-style-type: none"> Install applications on the subjected machines 	Practical Activity: <ul style="list-style-type: none"> Practice to make an account on appropriate cloud services Practice to install VM on cloud Practice to configure SSH and connect with local system 			
LU3: Configure Virtual Network	The trainee will be able to: <ul style="list-style-type: none"> Select required specification for network Select resources to create virtual network Launch resources to create virtual network Connect hosts with virtual network Test the virtual network 	<ul style="list-style-type: none"> Knowledge of resource groups at cloud. Creating a new resource group Knowledge to add a virtual network in this group Configuring IP and other parameters Process to create another virtual machine and connect it to the virtual network already created. Knowledge of SSH and FTP. Testing the virtual network using SSH, FTP or Telnet etc. Practical Activity: <ul style="list-style-type: none"> Deploy two virtual machines (VMs) securely communicate between VMs and connect to VMs from the internet. 	Total: 12 hrs Theory: 03 hrs Practical: 09 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Valid public cloud subscription Non Consumable <ul style="list-style-type: none"> Internet Computer system Multimedia CentOS Putty Vagrant 	Classroom, Computer Lab

				<ul style="list-style-type: none"> • Virtual Box • WinSCP 	
LU4: Perform Basic Security	The trainee will be able to: <ul style="list-style-type: none"> • Determine security requirements and specifications • Inspect network design to detect security flaws • Select security operation as per requirement • Add form for input controls like on off button 	<ul style="list-style-type: none"> • Understandings of cloud security • Knowledge of default security rule • Explain types of Security Vulnerabilities in the Cloud • Explain different firewall policies • Process to demonstrate and apply cloud computing service like Azure/Amazon boundary security best practices. • Process to demonstrate and apply cloud computing service like Azure/Amazon database security best practices • Process to demonstrate cloud computing service like Azure/Amazon data security and encryption best practices • Process to demonstrate and apply cloud computing service like Azure/Amazon identity management and access control security best practices • Understanding of Security lifecycle and measurements should be explained 	Total: 11 hrs Theory: 05hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Valid Cloud subscription Non Consumable <ul style="list-style-type: none"> • Internet • Computer system • Multimedia projector 	Class room, Computer Lab

		Practical Activity: <ul style="list-style-type: none"> Practice to prepare report to select security level on virtual machine 			
LU5: Perform Cloud Computation	The trainee will be able to: <ul style="list-style-type: none"> Determine the requirement and specification for computing of applications Launch cloud tool for required application Assign resources to host Install the required application as per instruction Test the environment 	<ul style="list-style-type: none"> Basic Understanding of cloud computing Characteristics of cloud computing Evaluate your applications to identify the required resources at cloud. Assigning resources to the application Common deployment of computing application at the cloud Practical Activity: <ul style="list-style-type: none"> Practice to Setup APP engine on VM and test the environment 	Total: 09 hrs Theory: 03 hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Valid cloud subscription Non Consumable <ul style="list-style-type: none"> Internet Computer system Multimedia projector 	Classroom, Computer Lab
LU6: Perform Cloud Networking	The trainee will be able to: <ul style="list-style-type: none"> Determine the requirement and specification for network 	<ul style="list-style-type: none"> Knowledge and understanding of different cloud server deployment models. Explain cloud networking and its applications. 	Total: 10 hrs Theory: 04 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers 	Classroom, Computer Lab

	<ul style="list-style-type: none"> • Launch resources to create virtual network • Connect the hosts with virtual network • Test the virtual network 	<ul style="list-style-type: none"> • Enlist steps to setup a virtual network at cloud. • Knowledge of Resource groups and available resources. • Knowledge of Infrastructure as a Service and other cloud reference models. <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to connect the hosts with virtual network and test the connectivity of virtual network 	<p>Practical: 06 hrs</p>	<ul style="list-style-type: none"> • Sharpeners • Valid cloud subscription <p>Non Consumable</p> <ul style="list-style-type: none"> • Internet • Computer system • Multimedia 	
<p>LU7: Create backup and restore virtual machine</p>	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> • Find suitable utilities • Install utility on sever • Create virtual machine image • Create job schedule for backups • Configure backup repository • Restore virtual machine backups 	<ul style="list-style-type: none"> • Understanding of virtual machines. • Creating a virtual machine • Working on command line interface of virtual machine at cloud. • Creating cron jobs at cloud to schedule backups. • Produce backups with timestamp identifier. • Creating cron jobs to remove backups with very old timestamps. • Restoring backups <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to create VM, backup and restore repository. 	<p>Total: 10 hrs</p> <p>Theory: 04 hrs</p> <p>Practical: 06 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Valid cloud subscription <p>Non Consumable</p> <ul style="list-style-type: none"> • Internet • Computer system • Multimedia projector 	Classroom, Computer Lab

LU8: Deploy Provisioning and Management	The trainee will be able to: <ul style="list-style-type: none"> • Determine the requirement and specification for deployment of resources. • Launch the cloud tool for deploying of application • Create the resources for required tasks • Install the required application as per instruction • Select the management tool to manage resources as per instruction • Make the local backup on storage device • Finalize the process 	<ul style="list-style-type: none"> • Determining the application requirements at cloud. • Handling user rights. • Configuring directory rights and application rights • Writing watchdogs for applications at cloud. • Explore any built in tools at cloud for provisioning and managing resources. • Using the provisioning and management tools at cloud. • Knowledge of DevOps. Practical Activity: <ul style="list-style-type: none"> • Perform backup operations 	Total: 09 hrs Theory: 03 hrs Practical: 06 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Valid cloud subscription Non Consumable <ul style="list-style-type: none"> • Internet • Computer system • Multimedia projector 	Classroom, Computer Lab

Module 11 : Develop program in Python

Objective of the module: The aim of this module to get knowledge, skills and understanding to develop program in Python.

	Duration:	52 Hours	Theory:	19 Hours	Practical:	33 Hours	
Learning Unit	• Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place		
LU1: Develop Basic programming concepts in Python	The trainee will be able to: <ul style="list-style-type: none">• Install Python• Set environment variables• Execute python script terminal• Declare variables according to the requirements• Use decision statement as per the requirement of problem• Initialize loop control variable• Declare and initialize different data structures• Define loop to access array• Access elements of array to perform actions as per requirement of the problem• Debug the code in case of error• Run the code to display the correct answer	<ul style="list-style-type: none">• Compilation steps of a Python program.• Knowledge of Debugger.• Installation of Compiler and IDE• Understanding of data types, list, tuple, set and dictionary• Implement arithmetic expression in Python• Understanding of precedence of operators• Describe Conditional Statements and its types• Understanding of nested decision statements.• Implementing Decision Control program in python• Explain Indexing and access of array• Process of implementing loops in a program in python• Process of debugging Practical Activit:	Total 26 hrs Theory: 11 hrs Practical: 15hrs	Consumable <ul style="list-style-type: none">• Notebooks• Pencils• Erasers• Sharpeners Non Consumable <ul style="list-style-type: none">• Internet• Computer system• C/C++ IDE• Python IDE• Multimedia• White board	Class room , Computer Lab		

		<ul style="list-style-type: none"> • Practice to calculate area of rectangle in Python • Practice to calculate gross salary of an employee from basic salary in Python • Practice to calculate grading system based on final marks of a class in Python • Practice to print table from 2 to 10 using nested FOR loop in Python • Practice to print table from 2 to 10 using nested WHILE loop in Python • Practice to print ATM option menu using DOWHILE loop in Python • Practice to fill 10 elements in array using loop in Python • Practice to take two character arrays in first insert string "Pakistan" and in 2nd insert "Zindabad" and take 3rd array and copy previous array elements in it and print 3rd array elements in Python • Practice to use list • Practice to use tuple • Practice to use sets 			
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LU02: Develop programs using basic classes	The trainee will be able to: <ul style="list-style-type: none"> • Declare the function, to perform the assigned task. • Call multiple functions with different parameters and display results. • Declare member functions and variables of the class • Create the objects • Access the functions and data of particular objects. • Debug the code in case of error • Run the code to display the correct answer 	<ul style="list-style-type: none"> • Describe Classes and its benefits • Explain member method and attributes or member variables • Explain how to declare a class and its member methods and member variables • Implementation of class using python • Concepts of object oriented program Practical Activity: <ul style="list-style-type: none"> • Practice to make function to calculate sum using call by reference and call by value • Practice to implement Object oriented concepts • Practice to create parent class and child class ➤ declare three functions to calculate average and sum with two and three variables each ➤ in child class override sum function 	Total 25 hrs Theory: 08 hrs Practical: 18hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • Jumper wire Non Consumable <ul style="list-style-type: none"> • Computer system • Sensor • Raspberry Pi • 	Class room Computer Lab
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		<ul style="list-style-type: none"> ➤ in main function create a child class object and calculate sum and average of two and three integers • Practice to create three child classes named as lion, dog and deer and apply the concept of polymorphism • Practice to write a Python program to interface sensor with Raspberry Pi and display real time values on 7 segment display 			
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Module 12 : Deploy hardware protection

Objective of the module: The aim of this module is to get knowledge, skills and understanding to deploy hardware protection. It provides an introduction to the main theories and activities associated with hardware security techniques being applied in network security at workplace.

Duration: 60 hours

Theory: 15 hours

Practical: 45 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Set Up a Basic Firewall	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> • Install firewall on operating system • Update firewall • Delete, disable, or rename any default user accounts, and change all default passwords • Create additional accounts with limited privileges based on responsibilities • Set up firewall zones and IP addresses • Configure access control lists (i.e set inbound and outbound rules) • Configure other firewall services and logging • Perform testing on firewall configuration • Update firmware and firewall, if required. 	<ul style="list-style-type: none"> • Knowledge of Firewall • Describe importance of firewall. • Understanding and knowledge of installation and updatation of firewall • Understanding of Firewall Protocols. • Understanding and knowledge of : <ul style="list-style-type: none"> ◦ Users account, privileges setting, IP, zones, Inbound and Outbound traffic, Ports and ACL. • Describe process of configuring a firewall for: <ul style="list-style-type: none"> ◦ Deletion of default account, ◦ Creation/renaming an account ◦ Ensuring password protection. ◦ Privileges setting. ◦ IP setting ◦ Setting Zones 	<p>Total 20 hrs</p> <p>Theory: 05 hrs</p> <p>Practical: 15 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White board markers <p>Non Consumable</p> <ul style="list-style-type: none"> • OS Bootable DVD • Mass storage device • Computer system • Hard drive • Firewall 	<p>Class room</p> <p>Lab</p> <p>And Industry visit/ISP visit.</p>

	<ul style="list-style-type: none"> • Generate report from firewall logs • Perform vulnerability scans 	<ul style="list-style-type: none"> ◦ Setting inbound and outbound setting and its importance. ◦ ACL ◦ White list • Knowledge of logging services in firewall. • Describe reports and logs and explain its importance. • Understanding of concepts: <ul style="list-style-type: none"> ➤ Vulnerability ➤ Threats ➤ Hackers ➤ Unwanted traffic ➤ Packets • Describe process of vulnerability scan. • Knowledge of Tools used for firewall scan. <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to configure hardware and software firewall 		<ul style="list-style-type: none"> • Vulnerability scanning tool • Multimedia projector • Instructional manual • UPS • Internet <p>Computer Networks</p>	
LU2: Protect IoT gateway from Wifi Attacks	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> • Detect intruders in the communication network through vulnerability scans • Select packet capture and injection in Wi-Fi attacks 	<ul style="list-style-type: none"> • Understanding of information security • Understanding data and packets • Understanding of intruders • Understanding of security threats • Understanding of security attacks 	<p>Total: 22 hrs</p> <p>Theory: 07 hrs</p> <p>Practical: 15 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners 	Class room , Computer Lab

	<ul style="list-style-type: none"> • Prepare IoT against Wi-Fi intruder attack • Apply AES/TKIP on IoT gateway • Apply MAC address filtering • Perform vulnerability test for IoT gateway 	<ul style="list-style-type: none"> • Differentiate between threats and attacks • Exemplify passive and active attacks • Understanding of Wifi and IoT gateway. • Explain authentication and encryption • Understanding of Wifi encryption. • Understanding the concept of ACL/MAC filtering in Wifi router. • Understanding of data confidentiality • Understanding of data integrity • Recognize security threats • Recognize security attacks • Demonstrate difference between physical attack, networks attack, software attack, and encryption attack with example • Describe process of vulnerability scan. • Knowledge of Tools used for scan. <p>Practical Activity:</p>		<ul style="list-style-type: none"> • White board markers • Non Consumable • Wifi router • Mass storage device • Computer system • Vulnerability scanning tool • Multimedia projector • IoT Network • Raspberry Pi • Raspberry Pi Adapter (5V, 2A) • SD card • SD card reader • Instructional manual • UPS 	
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		<ul style="list-style-type: none"> Practice to configure Raspberry Pi for DNS and Proxy server 		<ul style="list-style-type: none"> Internet 	
LU3: Secure device to device / end to end communication	The trainee will be able to: <ul style="list-style-type: none"> Implement microservices by applying physical security Manage any default user accounts, and change all default passwords Create additional accounts with limited privileges based on responsibilities Update firmwares Isolate IoT devices by securing device to device communication through wireless PAN protocols Secure cloud and IoT device connection by applying SSL Secure communication from device to gateway by encryption protocols 	<ul style="list-style-type: none"> Knowledge of end to end communication. Describe micro services. Understanding and knowledge of: <ul style="list-style-type: none"> ➤ Users account, ➤ Privileges setting, ➤ Update firmware, ➤ Isolation of communication devices. Understanding of IoT network Describe Isolation and its importance. Explain SSL. Understanding of SSL certificate Understanding of Physical security and techniques (Deterrence, delay and detect) Basic knowledge of Encryption protocol to secure communication devices. <p>Practical Activity:</p> <ul style="list-style-type: none"> Practice to make hardware firewall using Raspberry Pi and protect other devices. Practice to scan different vulnerable ports 	Total 18 hrs Theory: 03 hrs Practical: 15 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners White board markers Non Consumable <ul style="list-style-type: none"> Wifi router Computer system Vulnerability scanning tool Multimedia IoT Network Arduino/ NodeMCU Raspberry Pi Adapter for Raspberry Pi 	Class room Lab

		<ul style="list-style-type: none"> Practice to perform full security audit 		<ul style="list-style-type: none"> Internet 	
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Module 13 : Perform software security

Objective of the module: The aim of this module is to get knowledge, skills and understanding of perform software security

Duration: 37 hours **Theory:** 19 hours **Practical:** 18 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Apply Secure Service Layer(SSL) in client server applications	<p>The trainee will be able to:</p> <ul style="list-style-type: none"> Install OpenSSL library on server and client side. Create TCP socket and apply SSL on server application Create TCP socket and apply SSL on client application Generate SSL certificates for client. Install these certificates on server Establish SSL based client server communication 	<ul style="list-style-type: none"> Understand software security and communication protocol Understanding of transport layer protocol (TCP, UDP) Exemplify encryption and decryption Categorize software security components Understanding and knowledge of transport layer security Basic implementation knowledge of open SSL. Process to generate SSL certificate <p>Practical Activity:</p> <ul style="list-style-type: none"> Practice to install SSL on server Practice to install on client web apps 	<p>Total: 19 hrs</p> <p>Theory: 10 hrs</p> <p>Practical: 09 hrs</p>	<p>Consumable</p> <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners White board markers <p>Non Consumable</p> <ul style="list-style-type: none"> C/Python IDE Computer system Multimedia projector IoT Network 	Class room , Computer Lab

				<ul style="list-style-type: none"> • Arduino • NodeMCU • Instructional manual • Raspberry Pi • Raspberry Pi Adapter (5V, 2A) • SD card • SD card reader • UPS • Internet 	
LU2: Secure MQTT with Encryption and Decryption	The trainee will be able to: <ul style="list-style-type: none"> • Install NodeMCU Crypto module in Arduino IDE • Program NodeMCU to connect to a MQTT broker • Generate a pseudorandom initialization vector • Program a hash function for authentication with 	<ul style="list-style-type: none"> • Knowledge of publish subscribe model • Basic understanding of MQTT protocols • Knowledge of security ambiguities in MQTT protocol • Knowledge of different functions • Enlist attacks and threat in MQTT protocol • Process to connect MQTT client to a MQTT broker • Knowledge of Installing and using crypto module library. 	Total 18 hrs Theory: 9 hrs Practical: 09 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White board markers Non Consumable <ul style="list-style-type: none"> • C/Python IDE 	Class room Computer Lab

	<p>nodeid, iv, data, and session ID</p> <ul style="list-style-type: none"> • Compute a HMAC SHA1 • Store payload in a structure • Send payload structure via function • Load payload information • Compare the received and computed HMAC 	<ul style="list-style-type: none"> • Knowledge of Hashing and hashing function used in securing MQTT. <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to install NodeMCU Crypto module in Arduino IDE • Practice to program NodeMCU to connect to a MQTT broker • Practice to perform security audit 		<ul style="list-style-type: none"> • Computer system • Multimedia projector • Instructional manual • UPS • Internet • NodeMCU • MQTT broker 	
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Module 14 : Implement cryptography and network security

Objective of the module: The aim of this module is to get knowledge, skills and understanding to implement cryptography and network security. It provides an introduction to the main theories and activities associated with cryptographic techniques being applied in network security industry for the job at workplace.

Duration: 63 hours **Theory:** 18 hours **Practical:** 42 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Set up anaconda environment for security	The trainee will be able to: <ul style="list-style-type: none"> Download the Anaconda for python platform Install Anaconda Set environment variables Execute python script on Anaconda terminal 	<ul style="list-style-type: none"> Knowledge of basic elements of Cryptography, Hash Function and network security. Process to setup anaconda environment for python Knowledge of adding libraries using anaconda. Knowledge of different IDEs and environments for Python Practical Activity: <ul style="list-style-type: none"> Practice to configure environment for Python and sample program Practice to execute Python script on Anaconda terminal 	Total 18 hrs Theory: 06 hrs Practical: 12 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners White board markers Non Consumable <ul style="list-style-type: none"> Anaconda Software Computer system Multimedia projector Internet 	Class room , Computer Lab
LU2: Implement Cryptography	The trainee will be able to:		Total	Consumable	Class room

library in Anaconda environment	<ul style="list-style-type: none"> • Import cryptography library in new notebook • Apply cryptography library in program • Execute the Code • Verify the encrypted answer • Add the decryption code in program and execute again • Verify the answer for entered string 	<ul style="list-style-type: none"> • Knowledge of importing cryptography • Knowledge of cryptographic function • Knowledge of Implementation of encryption in python • Knowledge of Implementation of decryption in python <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice to add the encryption code in program and execute • Practice to add the decryption code in program and execute 	18 hrs Theory: 06 hrs Practical: 12 hrs	<ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White board markers <p>Non Consumable</p> <ul style="list-style-type: none"> • Anaconda Software • Computer system • Multimedia projector • Instructional manual • UPS • Internet 	
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LU3: Implement Hash Function in Anaconda environment	The trainee will be able to: <ul style="list-style-type: none"> • Import Hash Function library in new notebook • Apply hash functions in the program • Execute the code • Verify that entered string is Hash or not 	<ul style="list-style-type: none"> • Knowledge of importing Hashing • Knowledge of Hashing function • Knowledge of implementation of hashing function Practical Activity: <ul style="list-style-type: none"> • Practice to Apply hash functions in the program • Practice to Execute the code • Practice to Verify that entered string is Hash or not 	Total 24 hrs Theory: 06 hrs Practical: 18 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Erasers • Sharpeners • White board markers Non Consumable <ul style="list-style-type: none"> • Anaconda Software • Computer system • Multimedia projector • Internet 	Class room
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Module 15 : Manage and Supervise the Job Activities

Objective of the module: The aim of this module to get knowledge, skills and understanding to manage and supervise the job activities.

Duration: 32 hours

Theory: 20 hours

Practical: 12 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1: Plan for on-site operations	The trainee will be able to: <ul style="list-style-type: none"> Consult with the client to obtain required information Prepare SOP's in accordance with the identified requirements. Prepare the process flow diagram in order to achieve Quality outcome. Break down work of activities into small achievable components and efficient sequences 	<ul style="list-style-type: none"> Explain principles of planning and project management Explain roles and responsibilities for different levels of site supervision. Explain planning method for on-site operations Knowledge about process flow diagram Understanding of health and safety standards Understanding of house keeping 	Total 08 hrs Theory: 05 hrs Practical: 03 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils White board marker Non Consumable <ul style="list-style-type: none"> White board Multimedia Internet Computer system 	Class Room / Site

	<ul style="list-style-type: none"> • Recognize site hazards and the personal protective equipment (PPE) and safety procedures specified for job • Organize site induction for support personnel as required • Plan housekeeping activities prior to and post completion of work 	Practical Activity: <ul style="list-style-type: none"> • Practice to prepare activities plan for a specific crushing job order including break down of activities, recognize site hazards, prepare the demand of required equipment's and man power. 			
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LU2: Supervise work activities to achieve desired results	The trainee will be able to: <ul style="list-style-type: none"> • List and arrange required resources prior to commencement of work • Recognize the areas of work which could result in a delay of work, wastage of material or damage to tools. • Allocate responsibility to required team members to avoid conflicts • Review work plan in response to new information, urgent requests, changed situations or instructions from concern personnel • Cooperate with team members to achieve common goals 	<ul style="list-style-type: none"> • Understanding about causes of delay in work, wastage of material or damage to tools. • Explain documentation and record system of the inspection body Practical Activity: <ul style="list-style-type: none"> • Practice to manage task allocation to team member for the specific crushing job order, trace out the weak area of work and review the work plan. 	Total 08 hrs Theory: 05 hrs Practical: 03 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • White board marker Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	Class Room/ Plant Site
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LU3: Perform on- site inspection	The trainee will be able to: <ul style="list-style-type: none"> • Conduct inspection of processes & materials according to inspection plan • Identify defects and deficiencies in product & processes • Record defects and deficiencies with evidence in product & processes (if required) • Perform test as per standard procedure for determining the physical properties of materials and product. • Check the actions taken for rectification of snag list • Record the non-compliance and expected breaches of contract as per SOPs. 	<ul style="list-style-type: none"> • Describe the information relevant to inspection activities and document preparation for recoding inspection results. • Differentiate various types of deficiencies in inspection activities • Describe site problems and recommended corrective actions • Describe the procedure to perform on- site inspection Practical Activity: <ul style="list-style-type: none"> • Conduct inspection of crushing plant with emphasizes on deficiencies and defects in process & production including collection of sample of material & product and collect pictorial evidence etc. 	Total 08 hrs Theory: 05 hrs Practical: 03 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • White board marker Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	Class Room/ Plant Site
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LU4: Prepare the inspection report.	The trainee will be able to: <ul style="list-style-type: none"> • Collect and review the information relevant to inspection activities for recoding in section results • Verify the integrity of information supplied by other party as a part of the inspection process • Record inspection observations and findings • Recommend the necessary corrective actions for tackling the identified problems 	<ul style="list-style-type: none"> • Explain the procedure to prepare the inspection report. • Understanding about third/other party inspection process • Explain reporting standards Practical Activity: <ul style="list-style-type: none"> • Prepare the inspection report with respect to standards 	Total 08 hrs Theory: 05 hrs Practical: 03 hrs	Consumable <ul style="list-style-type: none"> • Notebooks • Pencils • Whit board marker Non Consumable <ul style="list-style-type: none"> • White board • Multimedia • Internet • Computer system 	Class Room
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Module 16 : Develop Entrepreneurial Skills

Objective of the module: After the completion of this competency standard, the Trainee will be expected to develop a business plan, collect information regarding funding sources, develop a marketing plan and develop basic business communication skills. Trainee'ss underpinning knowledge regarding entrepreneurial skills will be sufficient to provide you the basis for your work.

Duration:	28 hours	Theory:	16 hours	Practical:	12 hours
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Develop a business plan	Trainee will be able to: <ul style="list-style-type: none"> Conduct a market survey to collect following information: Select the best option in terms of cost, service, quality, sales, profit margin, overall expenses Compile the information collected through the market survey, in the business plan format 	<ul style="list-style-type: none"> Main elements of business plan Filling the business plan format Understanding of specific business terms used in the industry Process of conducting survey <ul style="list-style-type: none"> ➤ <u>Customer /demand</u> ➤ <u>Tools, equipment, machinery and furniture with rates</u> ➤ <u>Raw material</u> ➤ <u>Supplier</u> ➤ <u>Credit / funding sources</u> ➤ <u>Marketing strategy</u> ➤ <u>Market trends</u> ➤ <u>Overall expenses</u> ➤ <u>Profit margin</u> Describe 7Cs of business communication 	Total 07 hrs Theory: 04 hrs Practical: 03 hrs	<ul style="list-style-type: none"> Internet Computer White board Projector screen Multimedia projector 	Classroom

LU2. Collect information regarding funding sources	Trainee will be able to: <ul style="list-style-type: none"> Identify the available funding sources based on their terms and conditions, maximum loan limit, payback time, interest rate Choose the best available option according to investment requirement Prepare documents according to the loan agreement requirement Include the information of funding sources in the business plan 	<ul style="list-style-type: none"> Enlist the available funding sources Explain how to get loan to start a new business Explain market survey and its tools e.g.: questionnaire, interview, observation etc 	Total 07 hrs Theory: 04 hrs Practical: 03 hrs	<ul style="list-style-type: none"> Internet Laptop/Computer White board Projector screen Multimedia projector 	Classroom
LU3. Develop a marketing plan	Trainee will be able to: <ul style="list-style-type: none"> Collect information required to devise marketing plan Prepare marketing plan for new business 	<ul style="list-style-type: none"> 7ps of marketing including product, price, placement, promotion, people, packaging and positioning 	Total 07 hrs Theory: 04 hrs Practical: 03 hrs	<ul style="list-style-type: none"> Internet Laptop/Computer White board Projector screen Multimedia projector 	Classroom

LU4. Develop basic business communication skills	Trainee will be able to: <ul style="list-style-type: none"> • Communicate with internal customers e.g.: labor, partners and external customers e.g.: suppliers, customers etc., using effective communication skills • Use different modes of communication to communicate internally and externally e.g.: presentation, speaking, writing, listening, visual representation, reading etc. • Use specific business terms used in the market 	<ul style="list-style-type: none"> • Description of the market trends for specific product offering • Different modes of communication and their application in the industry 	Total 07 hrs Theory: 04 hrs Practical: 03 hrs	<ul style="list-style-type: none"> • Internet • Laptop/Computer • White board • Projector screen • Multimedia projector 	Classroom
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Module 17 : Create/Manage profile on Freelancing Platform

Objectiveb of the module: This competency standard covers the skills and knowledge required to create/manage profile on a non-traditional freelance platform.

Duration:	25 hours	Theory:	10 hours	Practical:	15 hours
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Setup Profile	Trainee will be able to: <ul style="list-style-type: none"> Set Up a Seller Profile Add personal and professional information on your profile Link up social media and other professional accounts to seller profile 	<ul style="list-style-type: none"> Knowledge of different freelance platforms Knowledge of traditional freelance platforms Knowledge of the difference between seller and buyer non-traditional freelancing Knowledge of different terminologies Understanding of gig economy Understanding to create profile on freelancing platforms 	Theory- 04 Hr Practical- 6 Hr Total- 10 Hr	<ul style="list-style-type: none"> Internet Computer Freelance platforms 	Classroom
LU2. Create the Gigs	Trainee will be able to: <ul style="list-style-type: none"> Find your ideal category and services Check out the competition Create an appealing title for the gig Choose subcategory and tags Create and price gig packages Win buyers with gig description 	<ul style="list-style-type: none"> Understanding of characteristics of a powerful gig 	Theory- 02 Hr Practical- 3 Hr Total- 05 Hr	<ul style="list-style-type: none"> Internet Computer Freelance platforms 	Classroom

	<ul style="list-style-type: none"> • Boost gig success with visuals • Choose a suitable gig package among Basic, Standard and Premium options 				
LU3. Provide High Quality Services as a seller.	Trainee will be able to: <ul style="list-style-type: none"> • Present a professional profile • Get and maintain high rating • Be responsive and polite to customer 	<ul style="list-style-type: none"> • Understanding about the rating policies 	Theory- 02 Hr Practical- 3 Hr Total- 05 Hr	<ul style="list-style-type: none"> • Internet • Computer • Freelance platforms 	Classroom
LU4. Develop / Increase Business	Trainee will be able to: <ul style="list-style-type: none"> • Deliver the work on agreed deadline • Ask for feedback form the client • Keep in touch with Buyers/Customers • Use the contacts page to maintain close coordination with the potential buyers/customers • Request customer to recommend you to other clients and work circles • Abide by the rules and regulations of freelance platform in order completion and cancelation 	<ul style="list-style-type: none"> • Knowledge of business strategies • Knowledge of basic terminologies used in freelancing like top sellers, competitors etc. 	Theory- 02 Hr Practical- 3 Hr Total- 05 Hr	<ul style="list-style-type: none"> • Internet • Computer • Freelance platforms 	Classroom

Module 18 : Write professional proposals for freelance projects

Objective of the module: This competency standard covers the skills and knowledge required to write professional proposals for freelance projects.

Duration:	16 hours	Theory:	10 hours	Practical:	06 hours
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Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU1. Write a winning proposal	Trainee will be able to: <ul style="list-style-type: none"> Start proposal with the lines which show your interest and care in the project Write ideas and suggestions in original sentences (Don't Copy & Paste) Present yourself as a problem solver in proposal, suggest one or two workable ideas for the project. Mention expertise to tell the buyer why you are the best person for the specific project Ask for the resources (Website link etc.) to get more familiar about the business/buyer Ask for the reply from the client in response to suggestions 	<ul style="list-style-type: none"> Knowledge of the good bid proposal features 	Theory- 05 Hr Practical- 3 Hr Total- 08 Hr	<ul style="list-style-type: none"> Computer Internet Web Browser Office Email services Freelance Platform 	Class Room Training Workshop Lab/ Field Visit
LU2. Adopt best practices of proposal writing	Trainee will be able to: <ul style="list-style-type: none"> Analyze the project details beforehand Avoid scripted bid proposals Don't sound impersonal 	<ul style="list-style-type: none"> Knowledge of 7c's of communication Understanding of buyer's history 	Theory- 05 Hr Practical- 3 Hr Total- 08 Hr	<ul style="list-style-type: none"> Computer Internet Web Browser Office 	Class Room Workshop Lab/ Field Visit

	<ul style="list-style-type: none"> • Avoid being too hasty in committing your time • Do not underbid fellow freelancers • Check buyer's history • Use phrases that sell in the market • Check competitor's reputation • Proofread the bid 	<ul style="list-style-type: none"> • Knowledge of competitors (direct/Indirect) • Understanding of Competitive analysis • Understanding of SWOT analysis 		<ul style="list-style-type: none"> • Email services • Freelance Platform 	
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Module 19 : Practice Professionalism

Objective of the module: This competency standard deal with learning the competencies needed to develop portfolio for industry. You can perform internship. Your underpinning knowledge will be sufficient to provide you the basis for your work.

Duration: 300 hours **Theory:** 100 hours **Practical:** 200 hours

Learning Unit	Learning Outcomes	Learning Elements	Duration	Materials Required	Learning Place
LU 1 Develop Portfolio for industry	The trainee will be able to: <ul style="list-style-type: none"> Select previous assignments for portfolio Work on previous selected assignments for portfolio Compile variety of assignments for portfolio Make Professional Portfolio for industry Develop Digital Portfolio for industry 	<ul style="list-style-type: none"> Describe different styles/format of portfolio Explain the importance of portfolio Practical Activity: <ul style="list-style-type: none"> Compile important assignments Prepare folder for assignments manually Prepare portfolio digitally 	Total 90 hrs Theory: 70 hrs Practical: 20 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers Sharpeners Non Consumable <ul style="list-style-type: none"> White board Multimedia 	Class Room Simulated environment
LU 2 Perform Internship	The trainee will be able to: <ul style="list-style-type: none"> Prepare for internship Personal Presentation Portfolio Presentation Interview preparation 	<ul style="list-style-type: none"> Explain importance of personal grooming for professional life Describe the importance of internship 	Total 210 hrs Theory: 30 hrs	Consumable <ul style="list-style-type: none"> Notebooks Pencils Erasers 	Class Room Crush plant site

	<ul style="list-style-type: none"> • Demonstrate Ethics for Internship • Identify Industry for internship • Perform Internship in Industry • Fill the Performa of Internship • Report the performance of internship 	<ul style="list-style-type: none"> • Explain ethics for work/internship <p>Practical Activity:</p> <ul style="list-style-type: none"> • Practice of presentation • Prepare CV for internship • Prepare report on performance of internship • Perform internship 	<p>Practical:</p> <p>180 hrs</p>	<ul style="list-style-type: none"> • Sharpeners <p>Non Consumable</p> <ul style="list-style-type: none"> • White board • Multimedia 	
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General assessment guidance for “*Internet of Things*”

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 Internet of Thing:

- Work performances, for example Create a simple app using app inventor that connects with Arduino board over Bluetooth and receive the sensor data to be displayed.
- Work Performances, for example Develop a regulated power supply that will power up your digital circuit
- Demonstrations, for example Design a Fan dimmer circuit.
- 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 Internet of Thing include:

- Work products, IOT Project portfolio
- 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, let's imagine if you have **thousands of sensors**, collecting various data all around us. A solution that scale would be to have these microcontrollers sending data securely to the Cloud.

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 “*Internet of Things*”

This curriculum consists of 101 modules

1. Interface long range wireless technologies (LoRa, NB IoT, MTC) with Micro-controller
2. Apply MQTT, CoAP, HTTP on IoT nodes
3. Configure IoT gateways (Wi-Fi/LoRa/NB-IoT)
4. Install/Configure Android Studio
5. Build mobile application

6. Build robust UI for greater UX (user experience)
7. Test, debug and use support libraries
8. Program/use background applications
9. Save user data/Integrate android application with database
10. Set up cloud sever
11. Develop program in Python
12. Deploy hardware protection
13. Perform software security
14. Implement cryptography and network security
15. Manage and Supervise the Job Activities
16. Develop entrepreneurial Skills
17. Create/Manage profile on Freelancing Platform
18. Write professional proposals for freelance projects
19. Practice professionalism

Sessional assessment

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

Theoretical assessment for all learning modules must consist of a written paper lasting at least half-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 -5

- Module 1 Interface long range wireless technologies (LoRa, NB IoT, MTC) with Micro-controller
- Module 2 Apply MQTT, CoAP, HTTP on IoT nodes
- Module 3 Configure IoT gateways (Wi-Fi/LoRa/NB-IoT)
- Module 4 Install/Configure Android Studio
- Module 5 Build mobile application
- Module 6 Build robust UI for greater UX (user experience)
- Module 7 Test, debug and use support libraries
- Module 8 Program/use background applications
- Module 9 Save user data/Integrate android application with database
- Module 10 Set up cloud sever
- Module 11 Develop program in Python
- Module 12 Deploy hardware protection
- Module 13 Perform software security
- Module 14 Implement cryptography and network security

Module 15 Manage and Supervise the Job Activities
Module 16 Develop entrepreneurial Skills
Module 17 Create/Manage profile on Freelancing Platform
Module 18 Write professional proposals for freelance projects
Module 19 Practice professionalism

For the final practical assessment 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 security services;

- Area of responsibility
- Tasks
- Guards
- Resources and duties

Complete list of tools and equipment

Sr#	Description	Quantity
1.	Android Studio	Free
2.	Arduino Uno	25
3.	USB mini wire	25
4.	Audio signal generator.	20
5.	AutoCAD software	5
6.	AVO meter/ Digital multimeter	25
7.	Backup software	Free
8.	Bluetooth module	30
9.	Bootable DVD	30
10.	Bootable OS Flash drive/CD	30
11.	Bread board	25
12.	Bread board / Basic electronics trainer kit	25
13.	Bread board / Digital Trainer Kit.	25
14.	Breadboard	25
15.	C IDE	Free
16.	C/C++ IDE	Free
17.	C/Python IDE	Free
18.	Card reader	50
19.	Circuit Breaker.	25
20.	Computer Networks	1
21.	Computer System Minimum 5th generation with 8 GB RAM and SSD	25
22.	Connecting Wires (FF, FM etc)	10 buses
23.	DC supply (5 V)	25
24.	DC\AC supply	25
25.	Digital clock	3
26.	Digital Multimeter	25

27.	Digital Trainer Kit.	20
28.	DLD trainer	20
29.	Dual trace Oscilloscope 0-20MHZ	20
30.	DVD or BLU-RAY writer	25
31.	Electrician Tool kit.	1
32.	ESP32	25
33.	External Hard disks	5
34.	Flash Drive	5
35.	Function Generator	25
36.	Hard Disk drives and Solid State disks.	25
37.	Instructional manual	5
38.	Insulation remover	25
39.	Internet	1
40.	Java IDE	2
41.	Keyborad	25
42.	Lamp holder	120
43.	Laptop	01
44.	Load (Lamp)	120
45.	Logic Probe.	5
46.	LoRA concentrator board	5
47.	LoRa module	5
48.	Manageable switch	4
49.	Mass Storage	5
50.	Modem/DSL	2
51.	Mouse	25
52.	MQTT broker	25
53.	MS Office	2
54.	MS Power BI	2
55.	Multi Meter	5
56.	Multimedia projector	1
57.	Networking Devices (Router, Modem, Hub, Firewall, Access Points, Switches etc)	2 Sets

58.	Networking Tool Kit	4 kits
59.	NFC	4
60.	Nodemcu Board	4
61.	NodeMCU module	4
62.	Nose Plier	25
63.	Office Suit	2
64.	OS Bootable Mass storage device	2
65.	Oscilloscope	5
66.	Pi Controller	50
67.	Plier	50
68.	Potentiometer	5
69.	Printer	2
70.	Projector	01 for each lab/class
71.	Projector screen	01 for each lab/class
72.	Python IDE	2
73.	RAID	2
74.	RAID card	2
75.	RAM	2 of each type
76.	RapidMiner (CD/Mass Storage)	2
77.	Raspberry Pi Adapter (5V, 2A)	4
78.	Raspberry Pi module	4
79.	Raspberry pi	4
80.	RFID antennas	2
81.	RFID reader	2
82.	Rheostat	2
83.	ROM	5
84.	Router	4
85.	Router software/Firmware.	2
86.	RS232 interfaces	25

87.	Scanner	2
88.	Screw	5
89.	SD card	5
90.	SD card reader	5
91.	Series board.	25
92.	Server machine	1
93.	Signal generator	5
94.	Simulator (Packet Tracer)	2
95.	Smartphone	2
96.	Software Development kit	2
97.	Software for Software based RAID.	2
98.	Software to test network.	2
99.	Solder	5
100.	Source of data sheets	2
101.	SPI Interface	5
102.	Step down Transformer	25
103.	Step down Transformer (Normal and center tapped)	25
104.	System (Windows, Linux)	2
105.	Tool kit.	5
106.	Trainer	5
107.	Troubleshooting software.	2
108.	UART transmitter	120
109.	USART transmitter	5
110.	USB micro cable	5
111.	USB mini cable	5
112.	Valid public cloud subscription	1
113.	Voltmeter	12
114.	VPN software.	2
115.	Vulnerability scanning tool	2
116.	Webcam	2
117.	Webcam (digital camera)	2

118.	Weka Software (CD/Mass Storage)	01
119.	White board	1 each class/lab
120.	Wifi module	5
121.	Wifi router	02
122.	Wire Tester	02
123.	Wireless router	02
124.	ZigBee modules	5

List of consumable supplies

1. Note books
2. Inventory registers
3. Pen
4. Pencils
5. Sharpeners
6. Erasers
7. White board markers (Different colors)
8. A4 papers
9. Valid cloud subscription
10. LEDs
11. Female to female header wires
12. Male to female header wires
13. Jumper wires
14. Resistances, capacitors, diodes, zener diode, relays, transistor etc.
15. PVC wires
16. Digital gates
17. Diac,
18. Triac,
19. FETs
20. RJ 45,
21. Category 5 &6 cable
22. Coaxial cable
23. DVD RWR
24. Soldering wire
25. Soldering paste
26. Two way switch
27. One way switch
28. AND gate (7408 2-input Quad)
29. Coupling capacitors
30. DIAC
31. Diodes
32. FET (JFET/MOSFET)
33. Humidity Sensor
34. IC 74147
35. IC 7445 BCD to decimal decoder
36. Inductors
37. Lamp
38. LM741 IC
39. Load (LED)
40. MOSFET
41. NAND gate (7400 2-input Quad)
42. Network cable CAT5,CAT6
43. NOR gate (7402 2-input Quad)
44. Power diodes (general purpose, Fast recovery & Schottky)
45. Push Button
46. PVC Pipe/Duct.
47. Resistive load
48. RFID tags
49. Safety procedures

50. Safety signs
51. SCR
52. Seven segment display
53. Single pole switch
54. Socket
55. Solenoid Valves
56. Temperature Sensor
57. Test Indicator.
58. TRIAC
59. UJT
60. White Board marker
61. Wooden/PVC board.
62. X-NOR gate (74266 2-input Quad)
63. X-OR gate (7486 2-input Quad)
64. Zener Diode
65. IR Sensor
66. IR Ultrasonic Sensor
67. NOT gate (7404 Hex NOT gate)
68. NOT gate (7404 Hex)
69. Occupancy Sensor
70. One 7404 IC – hex inverter (NOT gate)
71. OR gate (7410 3-input)
72. OR gate 7432 2-input Quad

Credit values

The credit value of the National Certificate Security Services 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
Interface long range wireless technologies (LoRa, NB IoT, MTC) with Micro-controller	46	4.6
Apply MQTT, CoAP, HTTP on IoT nodes	33	3.3
Configure IoT gateways (Wi-Fi/LoRa/NB-IoT)	50	5
Install/Configure Android Studio	46	4.6
Build mobile application	82	8.2
Build robust UI for greater UX (user experience)	46	4.6
Test, debug and use support libraries	52	5.2
Program/use background applications	78	7.8
Save user data/Integrate android application with database	83	8.3
Set up cloud sever	80	8
Develop program in Python	52	5.2
Deploy hardware protection	60	6
Perform software security	37	3.7
Implement cryptography and network security	63	6.3
Manage and Supervise the Job Activities	32	3.2

Competency Standard	Estimate of hours	Credit
Develop entrepreneurial Skills	32	3.2
Create/Manage profile on Freelancing Platform	25	2.5
Write professional proposals for freelance projects	16	1.6
Practice professionalism	300	30