National Occupational Standards

SIC - Internet of Things (Essentials of Internet of Things)

Unit Code: ELE/N0167

Version: 1.0

NSQF Level: 4.5

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Description

The 'SIC - Internet of Things' qualification is a comprehensive training program designed to equip participants with the knowledge and skills required to excel in the rapidly growing field of IoT. This course provides a deep dive into the fundamental concepts, hardware integration, programming, networking, and advanced applications of IoT. participants will acquire hands-on experience with Raspberry Pi configuration, sensor interfacing, circuit design, and basic electronics.

Scope

The scope covers the following :

- The scope covers the following:
- IoT Overview
- IoT Applications
- IoT Components
- IoT Platform

Elements and Performance Criteria

IoT Foundations

To be competent, the user/individual on the job must be able to:

PC1. Understand the basic definition of IoT, including its scope and evolution from early concepts to modern-day applications in smart homes, industrial automation, and more.

PC2. Explore key components of the IoT ecosystem, such as sensors, microcontrollers, and communication protocols like Wi-Fi, Zigbee, and LoRa, understanding how they interact for data processing and control.

PC3. Study the role of popular IoT platforms (AWS IoT, Azure IoT Hub, Google Cloud IoT), focusing on device management, security, and data processing. Learn to set up and configure platforms for IoT devices.

PC4. Investigate emerging IoT technologies such as 5G, edge computing, and AI integration into IoT, identifying their potential impact on various industries.

PC5. PC5: Learn about IoT security concerns such as vulnerabilities in data transmission, authentication methods, and implementing encryption protocols (SSL/TLS).

IoT Hardware and Sensors

To be competent, the user/individual on the job must be able to:

PC6. Understand the differences between microcontrollers (like Arduino) and microprocessors (like Raspberry Pi) and how to select the appropriate one for your project.

PC7. Learn to interface sensors (temperature, humidity, motion) with microcontrollers using GPIO pins, focusing on correct wiring, signal conditioning, and communication protocols.

PC8. PC8: Study power requirements of IoT devices, exploring methods like battery life optimization, energy harvesting, and power-saving techniques for sensor networks.

PC9. PC9: Practice calibrating sensors (e.g., humidity, temperature) to ensure data accuracy, learning how to handle sensor drift and environmental interference.

PC10. PC10: Explore the role of actuators in IoT systems (e.g., motors, servos), studying their interfaces and controlling them through microcontrollers.

IoT Networking and Communication

To be competent, the user/individual on the job must be able to:

PC11. Understand network architectures and topologies commonly used in IoT, including IP addressing, subnetting, and routing techniques.

PC12. Study networking protocols used in IoT such as HTTP, MQTT, and CoAP, understanding their advantages and use cases for data transmission in low-power devices.

PC13. Learn the basics of socket programming and how to implement client-server models to enable communication between IoT devices over networks.

PC14. Implement secure communication protocols using SSL/TLS and encryption methods to safeguard data in IoT systems, ensuring end-to-end security.

PC15. Learn to diagnose and troubleshoot network problems using tools like ping, traceroute, and Wireshark for efficient network management and debugging.

IoT Software Development and Data Management

To be competent, the user/individual on the job must be able to:

PC16. Learn Python programming basics and how to execute scripts for IoT projects. Understand libraries like GPIO Zero for controlling hardware on Raspberry Pi.

PC17. Implement techniques for data logging, collecting data from sensors, and storing it in databases or cloud platforms. Understand best practices for data handling. PC 17. Apply machine learning algorithms such as clustering, regression, and classification to datasets using Spark MLlib.

PC18. Use Python libraries like Pandas, Matplotlib, and Seaborn to visualize sensor data and generate insights. Explore methods to analyze trends in IoT data.

PC19. Understand how IoT platforms handle real-time data processing and apply edge computing for fast responses. Configure AWS Lambda or similar for real-time actions.

PC20. Create a mini project using Python and IoT platforms, focusing on sensor integration, data collection, and visualization, producing a working prototype.

Module 5: IoT Capstone Project

To be competent, the user/individual on the job must be able to:

PC21. Select an IoT problem to solve, apply design thinking principles, and plan the project by defining objectives, timeline, hardware, and software requirements.

PC22. Build the circuit using sensors, microcontrollers, and actuators. Learn to troubleshoot common hardware issues and verify sensor outputs.

PC23. Develop the software logic for data acquisition, control, and reporting. Integrate the use of Python with hardware interfaces for seamless operation.

PC24. Study the principles of UI/UX design for IoT applications, ensuring your project's interface is intuitive and user-friendly, optimizing for mobile devices if applicable.

PC25. Finalize the capstone project, presenting your solution with full documentation. Demonstrate how IoT technologies were applied to solve real-world problems, providing a clear evaluation of outcomes.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. Understand what IoT is and the breadth of its applications across various industries such as healthcare, agriculture, smart cities, and industrial automation.

KU2. Comprehend the layered architecture of IoT, including the perception layer (sensors and actuators), network layer (communication protocols), and application layer (software and analytics).

KU3. Identify and understand the roles of key components in IoT systems, including sensors, actuators, microcontrollers, microprocessors, gateways, and cloud services.

KU4. Understand various communication protocols used in IoT, such as MQTT, CoAP, HTTP/HTTPS, and WebSockets.

KU5. Learn about the role of IP addressing, especially IPv6, in IoT networks.

KU6. Familiarize with wireless communication technologies such as Wi-Fi, Bluetooth, Zigbee, LoRa, and cellular (2G, 3G, 4G, 5G).

KU7. Gain knowledge about data collection, transmission, and storage techniques.

KU8. Understand the importance of data processing, including edge computing and cloud computing.

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. Develop basic programming skills in languages commonly used in IoT, such as Python, C/C plus plus, and JavaScript.

GS2. Write scripts to interface with sensors, collect data, and perform simple data processing tasks.

GS3. Understand the basics of networking, including IP addressing, subnets, and routing.

GS4. Learn to use communication protocols like MQTT, HTTP, and CoAP to transmit data between devices and servers.

GS5. Develop skills in collecting, storing, and managing data from IoT devices.

GS6. Familiarize with databases and cloud storage solutions for IoT data management.

GS7. Develop problem-solving skills to identify and fix issues in IoT systems, including hardware, software, and network-related problems.

GS8. Use debugging tools and techniques to troubleshoot code and hardware configurations.

GS9. Learn to integrate various components of an IoT system, ensuring they work together seamlessly.

GS10. Understand the interoperability of different devices and protocols.

GS11. Develop skills to work effectively in teams, sharing knowledge and responsibilities in IoT projects.

GS12. Communicate technical concepts clearly to team members with varying levels of expertise.

GS13. Use project management tools and techniques to track progress and ensure successful project completion.

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
IoT Foundations	**13**	**-**	**-**	**-**
PC1. Understand the basic definition of IoT, including its scope and evolution from early concepts to modern-day applications in smart homes, industrial automation, and more.	2	-	-	-
PC2. Explore key components of the IoT ecosystem, such as sensors, microcontrollers, and communication protocols like Wi-Fi, Zigbee, and LoRa, understanding how they interact for data processing and control.	2	-	-	-
PC3. Study the role of popular IoT platforms (AWS IoT, Azure IoT Hub, Google Cloud IoT), focusing on device management, security, and data processing. Learn to set up and configure platforms for IoT devices.	3	-	-	-
PC4. Investigate emerging IoT technologies such as 5G, edge computing, and AI integration into IoT, identifying their potential impact on various industries.	3	-	-	-
PC5. PC5: Learn about IoT security concerns such as vulnerabilities in data transmission, authentication methods, and implementing encryption protocols (SSL/TLS).	3	-	-	-
IoT Hardware and Sensors	**13**	**-**	**-**	**-**
PC6. Understand the differences between microcontrollers (like Arduino) and microprocessors (like Raspberry Pi) and how to select the appropriate one for your project.	2	-	-	-
PC7. Learn to interface sensors (temperature, humidity, motion) with microcontrollers using GPIO pins, focusing on correct wiring, signal conditioning, and communication protocols.	2	-	-	-
PC8. PC8: Study power requirements of IoT devices, exploring methods like battery life optimization, energy harvesting, and power-saving techniques for sensor networks.	3	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC9. PC9: Practice calibrating sensors (e.g., humidity, temperature) to ensure data accuracy, learning how to handle sensor drift and environmental interference.	3	-	-	-
PC10. PC10: Explore the role of actuators in IoT systems (e.g., motors, servos), studying their interfaces and controlling them through microcontrollers.	3	-	-	-
IoT Networking and Communication	**14**	**-**	**-**	**-**
PC11. Understand network architectures and topologies commonly used in IoT, including IP addressing, subnetting, and routing techniques.	2	-	-	-
PC12. Study networking protocols used in IoT such as HTTP, MQTT, and CoAP, understanding their advantages and use cases for data transmission in low-power devices.	3	-	-	-
PC13. Learn the basics of socket programming and how to implement client-server models to enable communication between IoT devices over networks.	3	-	-	-
PC14. Implement secure communication protocols using SSL/TLS and encryption methods to safeguard data in IoT systems, ensuring end-to-end security.	3	-	-	-
PC15. Learn to diagnose and troubleshoot network problems using tools like ping, traceroute, and Wireshark for efficient network management and debugging.	3	-	-	-
IoT Software Development and Data Management	**14**	**-**	**-**	**-**
PC16. Learn Python programming basics and how to execute scripts for IoT projects. Understand libraries like GPIO Zero for controlling hardware on Raspberry Pi.	2	-	-	-
PC17. Implement techniques for data logging, collecting data from sensors, and storing it in databases or cloud platforms. Understand best practices for data handling. PC 17. Apply machine learning algorithms such as clustering, regression, and classification to datasets using Spark MLlib.	3	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC18. Use Python libraries like Pandas, Matplotlib, and Seaborn to visualize sensor data and generate insights. Explore methods to analyze trends in IoT data.	3	-	-	-
PC19. Understand how IoT platforms handle real-time data processing and apply edge computing for fast responses. Configure AWS Lambda or similar for real-time actions.	3	-	-	-
PC20. Create a mini project using Python and IoT platforms, focusing on sensor integration, data collection, and visualization, producing a working prototype.	3	-	-	-
Module 5: IoT Capstone Project	**14**	**-**	**32**	**-**
PC21. Select an IoT problem to solve, apply design thinking principles, and plan the project by defining objectives, timeline, hardware, and software requirements.	2	-	6	-
PC22. Build the circuit using sensors, microcontrollers, and actuators. Learn to troubleshoot common hardware issues and verify sensor outputs.	3	-	6	-
PC23. Develop the software logic for data acquisition, control, and reporting. Integrate the use of Python with hardware interfaces for seamless operation.	3	-	6	-
PC24. Study the principles of UI/UX design for IoT applications, ensuring your project's interface is intuitive and user-friendly, optimizing for mobile devices if applicable.	3	-	7	-
PC25. Finalize the capstone project, presenting your solution with full documentation. Demonstrate how IoT technologies were applied to solve real-world problems, providing a clear evaluation of outcomes.	3	-	7	-
NOS Total	**68**	**-**	**32**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N0167
NOS Name	SIC - Internet of Things (Essentials of Internet of Things)
Sector	Electronics
Sub-Sector	
Occupation	Product Design-S&C
NSQF Level	4.5
Credits	8
Minimum Educational Qualification & Experience	UG in relevant field (Or Equivalent) with NA of experience OR 12th Class with 1.5 years of experience OR Completed 3 year diploma after 10th with NA of experience OR 10th Class with 3 Years of experience OR Previous relevant Qualification of NSQF Level (Level 4) with 3 Years of experience
Version	1.0
Last Reviewed Date	27/08/2024
Next Review Date	27/08/2027
NSQC Clearance Date	27/08/2024
Reference code on NQR	NG-4.5-EH-02977-2024-V1-ESSC
NQR Version	1
CCN Category	1