**SKILLS FRAMEWORK FOR INFOCOMM TECHNOLOGY**
**TECHNICAL SKILLS & COMPETENCIES (TSC) REFERENCE DOCUMENT**

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| **TSC Category** | Development and Implementation | | | | | |
| **TSC Title** | Embedded Systems Programming | | | | | |
| **TSC Description** | Program an embedded system using permitted programming interfaces provided by the system to support creation of devices that do not operate on traditional operating systems | | | | | |
| **TSC Proficiency Description** | **Level 1** | **Level 2** | **Level 3** | **Level 4** | **Level 5** | **Level 6** |
| | | | | **ICT-DIT-4007-1.1** | **ICT-DIT-5007-1.1** | |
| | | | | Develop software applications and drivers to run in embedded systems, including rapid prototyping as well as the implementation of embedded software or firmware | Plan end to end process of incorporating embedded systems in hardware and devices, validating and optimising embedded software systems in different application areas | |
| **Knowledge** | | | | • Low-level programming languages and software syntax<br>• Embedded systems software architectures and interfaces<br>• Relevant operating systems, drivers and microcontrollers<br>• Control requirements for embedded system<br>• Tools for development and debugging of embedded software, including editor, assembler and cross assembler<br>• Rapid prototyping techniques<br>• Types and uses of sensors, electrical and electronic devices and components, and electrical wiring systems<br>• Types and characteristics of microcontrollers, | • Suitability and application of different programming languages for different purposes or contexts<br>• Embedded firmware and software engineering principles<br>• Types, characteristics and operating principles of binary and analogue input and output devices<br>• Hardware design tools, techniques and hardware control programming<br>• Range of software development and software configuration management tools<br>• Operating System coding techniques, interfaces and hardware subsystems<br>• Schematics, component data sheets and electronic test equipment | |

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| | | | | programming devices and programming software<br>• Data collection, transmission and communication protocols<br>• Security considerations for sensor networks | • Troubleshooting on embedded targets<br>• System optimisation techniques for both hardware and software performance<br>• Sensor properties and their application to electronic system programming | |
| **Abilities** | | | | • Develop software applications and drivers to run in an embedded operating system<br>• Interpret hardware and software communication and control requirements<br>• Conduct rapid prototyping of embedded control systems<br>• Implement embedded firmware or software drivers and applications on a microcontroller<br>• Employ hardware and software tests to test and analyse embedded programs and digital electronics<br>• Test logic connectivity and integrity of physical designs<br>• Verify embedded software designs according to quality and regulatory guidelines<br>• Manage all records and metrics related to embedded software development process<br>• Identify root cause of issues related to embedded software | • Plan end to end process from inception to deployment of embedded systems or microcontrollers for use in hardware and devices<br>• Define hardware and software communication and control requirements<br>• Align embedded system development with best practices for coding, reuse and portability<br>• Introduce new and emerging coding techniques or languages suitable for embedded systems programming<br>• Review coding, testing and design criteria<br>• Create technical manuscripts of embedded software or firmware operation<br>• Optimise embedded software systems in different application areas<br>• Solve problems using electronic circuits, control programs and software-hardware interface | |

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| **Range of Application** | |