

## SKILLS PROGRAMME DOCUMENT



Skills Programme Title		<b>C++ Programmer</b>			
NQF Level	4	Credits	60	Duration in days	75
Skills Programme ID		SP- 230374			
Skills Programme Status	Approved			Start Date	End Date
				11/03/2022	11/03/2027
Last date for enrolment	11/03/2028	Last date for achievement	11/03/2031		

<b>SKILLS PROGRAMME DETAILS</b>	
<b>1. Title:</b>	C++ Programmer
<b>2. Subtitle:</b>	OFO Title: Software developer OFO Code: 251201
<b>3. NQF Level:</b>	NQF Level 4
<b>4. Duration:</b>	75 Days
<b>5. Credits:</b>	60 Credits
<b>6. Quality Assuring Body:</b>	<b>Quality Council for Trades and Occupations (QCTO)</b>
<b>7. Skills Programme Rationale:</b>	<p>The need for this skills programme was identified after realising the importance and future impact of the 4IR on the economy of South Africa and its competitiveness. The Minister of Communications then gazetted the Presidential Commission on the Fourth Industrial Revolution (PC4IR) on 9 April 2019. In March 2020 this Commission delivered a report with wide ranging recommendations for Human Capital Development that will drive the 4IR forward.</p> <p>This report clearly indicated the speed at which companies will have to invest in big data analysis, web-enabled market investment and the use of cloud computing and machine learning. Programming skills and being competent in the use of programming languages such as C++ Language are central to these initiatives.</p> <p>The development of this C++ Programmer Skills Programme is also in support of the drivers for economic recovery as stated in the Economic Reconstruction and Recovery Plan (ERRP) and the subsequent Economic Reconstruction and Recovery Skills Strategy.</p> <p>International research confirms a phenomenal growth in the need for qualified programmers, including C++ Programmers, since C++ is a very popular programming language that has a number of application possibilities, e.g. game development, graphic user interface based applications, browsers, embedded systems, enterprise software, artificial intelligence, animation, etc. In South Africa, according to the 2020 list of occupations in high demand: Technical Report (Department of Higher Education and Training) published in 2021 it is clear that the role of the programmer and its derived skills programmes have been identified as pivotal by several Sector Education and Training Bodies (SETAs) as well as being in critical need by industry and academia alike. Responding to the rapid skills demand by supplying C++ Programmers will thus have a positive impact on the economy.</p> <p>Many job opportunities exist in any economic sector, e.g. finance, insurance, healthcare, energy, environmental, government, transportation, agriculture and food, promising a high-paying, rewarding career path. C++ Programmers may also become self-employed. The growth in new companies in an environment where digitisation is becoming more and more important, will have a positive impact on</p>

	<p>society, not only in terms of connectivity, ICT savvy, communications and the like, but also, as a new industry, there will be creation of jobs.</p> <p>No formal registration is required to function as a C++ Programmer.</p> <p>C++ Programmers can be employed in game development, graphic user interface based application development, browser development, embedded systems development, enterprise software development, artificial intelligence, animation, etc.</p> <p>Typical learners include school leavers and persons who want to enter the ICT sector with programming skills. Minimum requirements are a Gr 11 with Maths Lit and English.</p>	
<p><b>8. Related registered qualification(s):</b></p>	<ul style="list-style-type: none"> <li>• Occupational Certificate: Artificial Intelligence Software Developer, NQF Level 05, 209 Credits</li> <li>• Occupational Certificate: Cloud Administrator, NQF Level 04, 149 Credits</li> <li>• Occupational Certificate: Cybersecurity Analyst, NQF Level 05, 173 Credits</li> <li>• Occupational Certificate: Data Science Practitioner, NQF Level 05, 185 Credits</li> <li>• Occupational Certificate: Quality Test Automator, NQF Level 05, 179 Credits</li> <li>• Occupational Certificate: Software Developer, NQF Level 05, 220 Credits</li> </ul>	
<p><b>9. Purpose:</b></p>	<p>A C++ Programmer will be able to Implement solutions to solve real life problems in an efficient manner applying a knowledge and understanding of the principles of programming with C++ and applicable tools.</p> <p>Tasks that the learner will be able to know, do and understand after achievement of the skills programme include:</p> <ul style="list-style-type: none"> <li>• Create well-written and readable C++ programs, using a disciplined coding style, including documentation and indentation standards.</li> <li>• Work collaboratively in a team and execute version control.</li> </ul>	
<p><b>10. Content:</b></p>	<p><b><u>Knowledge Component</u></b></p> <ul style="list-style-type: none"> <li>• 900220-000-00-KM-01, C++ Basics, NQF Level 4, Credits 2</li> <li>• 900220-000-00-KM-02, Principles of Programming with C++, NQF Level 4, Credits 6</li> </ul>	<p><b><u>Application Component</u></b></p> <p><b>Practical Skills Modules:</b></p> <ul style="list-style-type: none"> <li>• 900220-000-00-PM-01, Getting started with C++, NQF Level 4, Credits 2</li> <li>• 900220-000-00-PM-02, Programming with C++, NQF Level 4, Credits 8</li> </ul>

	<ul style="list-style-type: none"> <li>• 900220-000-00-KM-03, Principles of Object Orientated Programming with C++, NQF Level 4, Credits 6</li> <li>• 900220-000-00-KM-04, Principles of Intermediate Programming with C++, NQF Level 4, Credits 7</li> </ul> <p>Total number of credits for Knowledge Modules: 21</p>	<ul style="list-style-type: none"> <li>• 900220-000-00-PM-03, Object Orientated Programming with C++, NQF Level 4, Credits 6</li> <li>• 900220-000-00-PM-04, Intermediate Programming with C++, NQF Level 4, Credits 9</li> <li>• 900220-000-00-PM-05, Projects with C++, NQF Level 4, Credits 14</li> </ul> <p>Total number of credits for Application Modules: 39</p>
<b>11. Minimum Requirements</b>	Grade 11 with Maths Lit and English. Access to equipment, internet connectivity and how to work remotely	
<b>12. Exit Level Outcomes (ELO) and Associated Assessment Criteria (AAC)</b>	<p><b>Exit Level Outcomes (ELO) 1</b> Describe the basics of C++ Programming</p> <p><b>Associated Assessment Criteria</b></p> <ul style="list-style-type: none"> <li>• Fundamentals of the C++ programming language are explained.</li> <li>• Basic concepts and methods of C++ object-oriented programming and object-oriented design are described.</li> <li>• The development life cycle as a means of creating C++ applications is described.</li> <li>• A thorough knowledge of the use of algorithms in problem solving is demonstrated.</li> </ul> <p><b>Exit Level Outcomes (ELO) 2</b> Programme effectively using C++ frameworks and functionalities</p> <p><b>Associated Assessment Criteria</b></p> <ul style="list-style-type: none"> <li>• The use of C++ syntax is demonstrated by creating neat and concise coding including application of documentation and indentation standards.</li> <li>• Well-written and readable C++ programs are created, using a disciplined coding style, including comments and indentation standards.</li> <li>• Procedural and object oriented concepts and syntax are applied.</li> <li>• The ability to troubleshoot problems with application development is demonstrated and application is debugged.</li> </ul> <p><b>Exit Level Outcomes (ELO) 3</b> Work collaboratively in a team using the GitHub platform</p> <p><b>Associated Assessment Criteria</b></p> <ul style="list-style-type: none"> <li>• An ability to work with Git and GitHub functionalities is demonstrated.</li> <li>• The ability to work collaboratively in a team using Git is applied</li> <li>• Version control is executed using Git functionalities such as repositories, branches, commits and pull requests.</li> </ul>	

<p><b>13. Continuous Assessment and Final Integrated Supervised Assessment (FISA)</b></p>	<p><b>Continuous Assessment</b></p> <p>The SDP must ensure that all learners are enrolled with the QCTO at the start of training (within 5 days) in the format required by the QCTO. Continuous assessments are set by the SDP in accordance with the outcomes provided.</p> <p>This may consist of a variety of methods, e.g. practical or written assessments, assignments, projects, demonstrations, presentations or any other form of assessment to assist the learner in the learning process.</p> <p>During training, it is mandatory for formal summative assessments to take place at the end of each module/topic. These results must be formally recorded, and be available for monitoring and/or evaluation by the QCTO.</p> <p><b>Final Integrated Supervised Assessment (FISA)</b></p> <p>All learners gain entrance to the Final Integrated Supervised Assessment by successfully completing all formal summative assessments conducted by the SDP.</p> <p>Format of FISA: A practical assessment integrating the relevant Exit Level outcomes, with simultaneous verbal assessment of embedded knowledge by the assessor before, during or after the FISA.</p> <p>All FISAs must be supervised, and virtual FISAs must be recorded throughout the assessment.</p> <p>All Exit Level Outcomes must be covered in the FISA. In the FISA, the learner must demonstrate applied knowledge and skills to prove that the competencies of the Skills Programme have been achieved.</p> <p>The FISA may not contain any assessments used in the "Continuous Assessment" process (thus no re-assessment).</p> <p>Special considerations should be made for candidates with special learning needs.</p> <p><b>Standards for Final Integrated Supervised Assessment (FISA):</b></p> <p>The learner should be provided with a brief/job card/task to demonstrate what the learner should show, know or produce in a product, relevant to the Exit Level Outcomes. This is the section where the learner must show applied competency (what the learner must be able to do, and to what expected standard).</p> <p>The FISA INSTRUMENT (Written case study, scenario or brief/task [similar to a job card]) must be developed and moderated by the SDP and conducted in a supervised environment. It is assessed by means of a RUBRIC developed by the SDP for this purpose.</p>
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A candidate must demonstrate that they are competent at using appropriate toolkit, accessing programming building blocks and work within a repository and create a well-written and readable C++ programme.

The candidate must be given access to internet connection, applicable software and hardware as well as a **simulated** platform or lab environment with applicable toolkit and virtual machines with access to sufficient information. Candidates must be provided with a scenario or customer brief related to the company for writing a programme at beginner's level and be able to:

1. Create a well-written and readable C++ program, using a disciplined coding style, including documentation and indentation standards.
2. Use Git functionalities for working collaboratively in a team and execute version control.

The maximum time for the above is 6 hours.

Pass mark is 75%.

Whilst conducting the above, strategic, well-timed questions should be asked of the learner to assess embedded knowledge gained during the skills programme, as well as critical thinking and problem-solving skills: for e.g.

- "Why.....?"
- "What would happen if ...?"
- "When ..... is done, what would the result be?"
- "How would you deal with .....?"
- Etc.

The marking rubric/compliance checklist used to assess these competencies must include a section for the assessor/facilitator used in this session to make a note of competencies shown, (or not shown), as well as the questions that were asked, and a summary of the learner's answers, and state whether these are of the acceptable standard or not.

The marking rubric/compliance checklist compiled should contain specific areas marked with an asterisk (\*) as compulsory sections in order for the learner to be declared C (Competent). Compulsory sections are when the safety of the candidate or others would be affected if incorrectly completed.

#### **Submission of final results**

Final results must be submitted to the QCTO in the required format, within 21 days of the date of the FISA, together with the following:

- Completed QA Verification Report on the FISA (QCTO template: relevant sections).

	<ul style="list-style-type: none"> <li>• A copy of the final Assessment Instrument used, as well as the marking guideline / rubric.</li> </ul>
<b>14. Recognition of Prior Learning:</b>	<ul style="list-style-type: none"> <li>• Learners will gain access to the skills programme through RPL for access as provided for in the QCTO RPL Policy. RPL for access is conducted by accredited education institution, skills development provider or workplace accredited to offer that specific skills programme.</li> <li>• Learners who have acquired competencies in skills programme will be credited for such topics through RPL.</li> <li>• RPL for access to the Final Supervised Assessment: Accredited providers and approved workplaces must apply the internal assessment criteria specified in the skills programme document to establish and confirm prior learning and achievement of required competencies for the skills programme.</li> </ul>
<b>15. Work Opportunities / Further Learning:</b>	<p>Employment opportunities:</p> <ul style="list-style-type: none"> <li>• Self-employed,</li> <li>• Working remotely,</li> <li>• Programming companies,</li> <li>• Any industry.</li> </ul> <p>Further learning opportunities:</p> <ul style="list-style-type: none"> <li>• Occupational Certificate: Artificial Intelligence Software Developer, NQF Level 05, 209 Credits</li> <li>• Occupational Certificate: Cloud Administrator, NQF Level 04, 149 Credits</li> <li>• Occupational Certificate: Cybersecurity Analyst, NQF Level 05, 173 Credits</li> <li>• Occupational Certificate: Data Science Practitioner, NQF Level 05, 185 Credits</li> <li>• Occupational Certificate: Quality Test Automator, NQF Level 05, 179 Credits</li> <li>• Occupational Certificate: Software Developer, NQF Level 05, 220 Credits</li> </ul>
<b>16. Skills Development Provider Accreditation Requirements</b>	<p><b>Knowledge Modules</b></p> <p><i>Physical Requirements:</i></p> <ul style="list-style-type: none"> <li>• The provider must have lesson plans and structured learning material or provide learners with access to structured learning material that addresses all the topics in all the knowledge modules as well as the applied knowledge in the application.</li> </ul>

	<ul style="list-style-type: none"> <li>• QCTO/ MICT SETA requirements</li> </ul> <p><i>Human Resource Requirements:</i></p> <ul style="list-style-type: none"> <li>• Lecturer/learner ratio of 1:20 (Maximum)</li> <li>• Qualification of lecturer (SME): <ul style="list-style-type: none"> <li>○ NQF 5 qualified in industry recognised qualifications with 1-year experience in the IT industry</li> <li>○ Cybersecurity vendor certification</li> </ul> </li> <li>• Assessors and moderators: accredited by the MICT SETA</li> </ul> <p><i>Legal Requirements:</i></p> <ul style="list-style-type: none"> <li>• Legal (product) licences to use the software for learning and training</li> <li>• OHS compliance certificate</li> </ul> <p><b>Application Modules</b></p> <p><i>Physical Requirements:</i></p> <ul style="list-style-type: none"> <li>• Valid licenses software and application, including OS.</li> <li>• Internet connection and hardware availability.</li> <li>• Examples and information specified in the scope statement and all the case studies, scenarios and access to hardware and software implied in the scope statements of the modules.</li> <li>• Remote learners: Provider must provide business IT simulation system (e.g. invoice processing).</li> </ul> <p><i>Human Resource Requirements:</i></p> <ul style="list-style-type: none"> <li>• Qualification of lecturer (SME): <ul style="list-style-type: none"> <li>○ NQF 5 industry recognised qualification with 1 year relevant experience</li> </ul> </li> <li>• Assessors and moderators: accredited by the MICT SETA</li> </ul> <p><i>Legal Requirements:</i></p> <ul style="list-style-type: none"> <li>• Legal (product) licences to use the software for learning and training</li> <li>• OHS compliance certificate</li> <li>• Ethical clearance (where necessary)</li> </ul>
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