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## GOVERNMENT NOTICES

## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

No. 918

5 September 2008



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Standards Generating Body (SGB) for

**Generic Manufacturing, Engineering and Technology**

registered by Organising Field 06 – Manufacturing, Engineering and Technology, publishes the following Unit Standards for public comment.

This notice contains the title, field, sub-field, NQF level, credit, and purpose of the Unit Standards. The full Unit Standards can be accessed via the SAQA web-site at [www.saga.org.za](http://www.saga.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the Unit Standards should reach SAQA at the address below and **no later than 5 October 2008**. All correspondence should be marked **Standards Setting – SGB for Generic Manufacturing, Engineering and Technology** and addressed to

The Director: Standards Setting and Development  
SAQA

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DR. S. BHIKHA

DIRECTOR: STANDARDS SETTING AND DEVELOPMENT



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Operate and monitor a milling machine***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258678	Operate and monitor a milling machine		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Generic Manufacturing, Engineering & Technology			
<b>FIELD</b>	<b>SUBFIELD</b>		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 2	12

***This unit standard replaces:***

<b>US ID</b>	<b>Unit Standard Title</b>	<b>NQF Level</b>	<b>Credits</b>	<b>Replacement Status</b>
13204	Operate and monitor a milling machine to produce simple components	Level 2	12	Will occur as soon as 258678 is registered

**SPECIFIC OUTCOME 1**

Explain and discuss milling machine components and operations.

**SPECIFIC OUTCOME 2**

Plan and prepare for milling operation.

**SPECIFIC OUTCOME 3**

Perform and quality check milling operation.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

None





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Operate and monitor a lathe***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258679	Operate and monitor a lathe		
<b>ORIGINATOR</b>			<b>PROVIDER</b>
SGB Generic Manufacturing, Engineering & Technology			
<b>FIELD</b>			<b>SUBFIELD</b>
6 - Manufacturing, Engineering and Technology			Manufacturing and Assembly
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 2	12

***This unit standard replaces:***

<b>US ID</b>	<b>Unit Standard Title</b>	<b>NQF Level</b>	<b>Credits</b>	<b>Replacement Status</b>
13205	Operate and monitor a lathe to produce simple components	Level 2	12	Will occur as soon as 258679 is registered

**SPECIFIC OUTCOME 1**

Demonstrate knowledge pertaining to turning operations.

**SPECIFIC OUTCOME 2**

Prepare for turning operations.

**SPECIFIC OUTCOME 3**

Perform turning operations.

**SPECIFIC OUTCOME 4**

Apply quality checks on turned component and report on operations.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

None



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Operate and monitor a drilling machine***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258681	Operate and monitor a drilling machine		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Generic Manufacturing, Engineering & Technology			
<b>FIELD</b>	<b>SUBFIELD</b>		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 2	6

***This unit standard replaces:***

<b>US ID</b>	<b>Unit Standard Title</b>	<b>NQF Level</b>	<b>Credits</b>	<b>Replacement Status</b>
13214	Operate and monitor a drilling machine to produce simple components	Level 2	6	Will occur as soon as 258681 is registered

**SPECIFIC OUTCOME 1**

Demonstrate knowledge pertaining to drilling operations.

**SPECIFIC OUTCOME 2**

Prepare for drilling operations.

**SPECIFIC OUTCOME 3**

Perform drilling operations.

**SPECIFIC OUTCOME 4**

Apply quality checks on drilled component and report on operations.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

None



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Operate and monitor a surface grinding machine***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258695	Operate and monitor a surface grinding machine		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Generic Manufacturing, Engineering & Technology			
<b>FIELD</b>	<b>SUBFIELD</b>		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 2	8

***This unit standard replaces:***

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13215	Operate and monitor a surface grinding machine to produce simple components	Level 2	8	Will occur as soon as 258695 is registered

**SPECIFIC OUTCOME 1**

Explain and discuss surface grinding machine, accessories and operations.

**SPECIFIC OUTCOME 2**

Plan and prepare for surface grinding operation.

**SPECIFIC OUTCOME 3**

Perform and quality check surface grinding operation.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

None

No. 919

5 September 2008

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Standards Generating Body (SGB) for

**Generic Manufacturing, Engineering and Technology**

registered by Organising Field 06 – Manufacturing, Engineering and Technology, publishes the following Qualification and Unit Standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the Qualification and Unit Standards. The full Qualification and Unit Standards can be accessed via the SAQA web-site at [www.saqqa.org.za](http://www.saqqa.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the Qualification and Unit Standards should reach SAQA at the address below and **no later than 5 October 2008**. All correspondence should be marked **Standards Setting – SGB for Generic Manufacturing, Engineering and Technology** and addressed to

The Director: Standards Setting and Development  
SAQA  
*Attention: Mr. D. Mphuthing*  
Postnet Suite 248  
Private Bag X06  
Waterkloof  
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or faxed to 012 – 431-5144  
e-mail: [dmphuthing@saqa.org.za](mailto:dmphuthing@saqa.org.za)

**DR. S. BHIKHA****DIRECTOR: STANDARDS SETTING AND DEVELOPMENT**



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**QUALIFICATION:**

**Further Education and Training Certificate: Mechanical Engineering: Machining and Tooling**

SAQA QUAL ID	QUALIFICATION TITLE		
63629	Further Education and Training Certificate: Mechanical Engineering: Machining and Tooling		
ORIGINATOR		PROVIDER	
SGB Generic Manufacturing, Engineering & Technology			
QUALIFICATION TYPE	FIELD	SUBFIELD	
Further Ed and Training Cert	6 - Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	MINIMUM CREDITS	NQF LEVEL	QUAL CLASS
Undefined	132	Level 4	Regular-Unit Stds Based

***This qualification does not replace any other qualification and is not replaced by another qualification.***

**PURPOSE AND RATIONALE OF THE QUALIFICATION**

Purpose:

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering machining skills to meet the challenges of such an environment.

The primary skill that is recognised in this qualification is the ability to produce components of some complexity using a variety of machining methods. This capability requires an understanding of advanced machining theory, detailed engineering drawings and a variety of tests and treatments used on engineering metals. Hand skills play a large role in this qualification.

Qualifying learners will also be able to relate what they are doing to scientific and technological principles and concepts. They will also be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

Qualifying learners at NQF Level 4 will be able to:

- > Produce components using complex machining processes to meet operational and output requirements using a variety of machining methods, machines and operations in accordance with legal, health, safety and environmental requirements.
- > Apply and sustain quality specifications to meet output requirements in producing complex components.
- > Maintain and support procedures to fault-find and solve a variety of familiar and unfamiliar machining problems, taking responsibility and making decisions.
- > Analyse and communicate information to identify problems and determine trends.

**Rationale:**

The qualification addresses needs as identified in the machining disciplines as part of the mechanical engineering sector to ensure that there is a capacity to meet the growth demand of the sector. The mechanical engineering sector broadly refers to manufacturing plants, processing plant and other industrial operations, ensuring that production efficiencies, plant and machine availability and quality of output are consistently maintained in support of competitiveness. This occupational qualification serves the need of the society and the economy by providing engineering support services in the manufacture and maintenance of machinery, plant and engineering systems in industries such as:

- > Manufacturing and Engineering (Metals, Plastics, Tyre and Rubber, Automotive Manufacturing, Packaging, Capital equipment, Tooling, Agro-processing).
- > Chemical, Petrochemical, Pharmaceuticals.
- > Mining.
- > Transport (Maritime, Road, Rail and Aviation).
- > Civil Engineering and Construction.
- > Food and Beverages.
- > Defence.
- > Energy (generation, transmission, distribution, maintenance, alternative, renewable, domestic).
- > Other engineering-related industry sectors (health, safety).

The industries within these sectors include specific needs related to amongst others:

- > Design.
- > Industrialisation.
- > Manufacturing.
- > Maintenance.
- > Mechanical engineering related information communication technology.

The range of typical learners at this level could include individuals preparing to qualify in occupations or trades such as:

- > Turners.
- > Tool, jig, mould and die makers.
- > Machinists.

This mechanical engineering qualification provides the learner with the intermediate skills, knowledge and competencies that are required within the machining environment providing a common set of specialisation skills in Machining, Tool, Die, Mould and Jig Making at NQF Level 3. This leads to further specialisations within each of these categories at a NQF Level 4.

This qualification could assist with the achievement of national governmental and industrial development policies and strategies to grow the pool of scarce and other related skills in support of sustainable economic growth. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured. Through its design, this qualification will meet the needs of learners within the mechanical engineering sector who require technical expertise and essential knowledge needed to earn formal qualifications. This qualification facilitates access for previously disadvantaged groups and other learners to acquire the technical knowledge and skills that are required as well as provide access and mobility into higher-level more specialised occupations. This will allow the learner greater employability and support the development of small, medium enterprises (SME).

**RECOGNIZE PREVIOUS LEARNING?**

Y

**LEARNING ASSUMED IN PLACE**

This qualification assumes learners have a national certificate in mechanical engineering Machining at NQF Level 3 or equivalent.

If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include:

- > Communication at NQF Level 3.
- > Mathematical literacy at NQF Level 3.
- > Science and technology concepts at or equivalent to NQF Level 3.
- > Produce components by performing engineering grinding operations at NQF Level 3.
- > Produce components by performing engineering milling operations at NQF Level 3.
- > Produce components by performing engineering turning operations at NQF Level 3.
- > Produce detailed engineering drawings at NQF Level 3.

**Recognition of Prior Learning:**

This qualification can be obtained wholly or in part through the recognition of prior learning (RPL). The learner should be thoroughly briefed on the process. Support and guidance should be provided. The process should not be so onerous as to prevent learners from taking up the RPL option in obtaining the qualification.

**Access to the Qualification:**

Open.

**QUALIFICATION RULES****Fundamental Component:**

The Fundamental Component consists of unit standards in:

- > Communications at NQF Level 4 to the value of 20 credits.
- > Communications at NQF Level 3 to the value of 20 credits.
- > Mathematical Literacy at NQF Level 4 to the value of 16 credits.

All Unit Standards to the value of 56 credits in the Fundamental Component are compulsory.

**Core Component:**

The Core Component consists of Unit Standards to the value of 56 credits, all of which are compulsory.

**Elective Component:**

The Elective Component consists of a number of unit standards that can be utilized for various specialization areas. Learners are to choose Elective Unit Standards to the value of 20 credits from the Elective Unit standards so as to attain a minimum of 132 credits for this qualification.

These 20 credits could be chosen as clusters of unit standards from Chemical, Tooling, Metrology, CNC, Machining or any other metal or other industries in order to facilitate specialisations or the registration of learning programmes in specialisation areas.



**EXIT LEVEL OUTCOMES**

On completion of this Qualification learners are able to:

1. Produce components using complex machining processes to meet operational and output requirements using a variety of machining methods, machines and operations in accordance with legal, health, safety and environmental requirements.

> Range: Complex machining processes includes Internal taper; Multi start thread; Matching tapers; Differential indexing (gear cutting); Rack and pinion; Spline shaft; Spurr gear; Step boring (vertical and horizontal), machine tapping and reaming.

> Range: Operational and output requirements include maintenance, manufacturing, planning, customer, management and quality.

> Note: Produce includes the machining of components for maintenance and/or productions requirements.

2. Apply and sustain quality specifications to meet output requirements in producing complex components.

> Range: Quality specifications include quantity, time, tolerance, cost effectiveness, functionality.

3. Fault-find and solve a variety of familiar and unfamiliar machining problems, taking responsibility and making decisions.

4. Analyse and communicate information to identify problems and determine trends.

**Critical Cross-field Outcomes:**

The critical cross-field outcomes are supported by the exit level outcomes as follows:

Identifying and solving problems in which responses display that responsible decisions using critical thinking have been made:

> Related to the application of mechanical technology and skills.

> In preparation and during the execution of job activities.

> Solving familiar maintenance problems.

Working effectively with others as a member of a team, group, organization and community:

> All tasks and work-related experience are performed within a team environment.

> Taking into account, the safety of others.

> Communicating with production, quality control and supervisory personnel and/or clients.

Organising and managing oneself and one's activities responsibly and effectively:

> Related to planning and preparation of fitting tasks.

Collecting, analyzing, organizing and critically evaluating information:

> Related to planning and preparation in order to execute job activities.

> Completion of technical reports related to the job activity.

> Solve familiar problems related to maintenance tasks at hand.

Communicating effectively using visual, mathematical and/or language skills:

> During planning, preparation and the execution of job activities Completion of technical reports related to the job activity.



- > Communicating effectively by verbal explanation.
- > Communicating as a part of a team.

Using science and technology effectively and critically, showing responsibility towards the environment and health of others when:

- > Understand and explain machining theory and mathematical and scientific concepts underpinning the machining operation.

Demonstrating an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation when:

- > The relationship of the drawing to the final machined component.
- > The purpose and uses of the machined component.

### **ASSOCIATED ASSESSMENT CRITERIA**

Associated Assessment Criteria for Exit Level Outcome 1:

- 1.1 Components are machined according to specifications and machining requirements.
- 1.2 Complex components are produced according to the process plan and operation sheet.
- 1.3 Decisions are made on machining process requirements for a specific machining operation.
  - > Range: Machining process requirements include methods, machines, equipment.
- 1.4 Components are machined according to specifications in terms of health, safety and environmental requirements.
- 1.5 Machining methods, machines and operations related to complex machining processes are explained to reflect their impact on operational and output requirements.

Associated Assessment Criteria for Exit Level Outcome 2:

- 2.1 Quality specifications and the principles underpinning such specifications are interpreted to sustain maintenance and output requirements.
- 2.2 Quality specifications are applied in order to produce complex components.
- 2.3 Inspection methods are utilised in order to evaluate component compliance with specifications.
- 2.4 Inspection data are interpreted in order to adjust machining processes.
  - > Range: Inspection data include finishing, temperature, type of coolant, speed, feed, size, equipment.
- 2.5 Quality specifications related to complex machining processes are explained to reflect their impact on producing complex components.

Associated Assessment Criteria for Exit Level Outcome 3:

- 3.1 Familiar problems are solved by using the specified procedures within a machining environment.
  - > Range: Familiar problems include but are not limited to rough cut, surface finishing, maintaining dimensions, machinery operations, tooling.
- 3.2 Solutions to familiar and unfamiliar machining problems are based on a clear analysis of information gathered through diagnostic procedures.
- 3.3 Machining procedures are adjusted to respond to unfamiliar problems.
- 3.4 Issues related to familiar and unfamiliar problems are discussed to reflect their impact on the machining of complex components.
- 3.5 All actions related to problem solving are reported and recorded for future reference in accordance with organisational procedures.

Associated Assessment Criteria for Exit Level Outcome 4:

- 4.1 Machined component compliance is determined and reported to communicate information on machining processes and results.
- 4.2 Conditions, evidence and incidences are reported accurately in a timely manner and discussed with peers and management.
- 4.3 Data gathered through diagnostic procedures is analysed systematically to solve problems.
- 4.4 Records are kept for scrutiny and future reference in accordance with organisational procedures.
- 4.5 Communication and information analysis requirements are explained to reflect their impact on the need to determine trends.

#### Integrated Assessment:

- > Assessment practices must be open transparent fair valid and reliable and should ensure that no learner is disadvantaged in any way whatsoever, so that an integrated approach to assessment is incorporated into the qualification.
- > Learning teaching and assessment are inextricably interwoven. Whenever possible the assessment knowledge skills attitudes and values shown in the unit standards should be integrated.
- > Assessment of Communication and Mathematical Literacy should be integrated as far as possible with other aspects and should use practical administration contexts wherever possible. A variety of methods must be used in assessment and tools and activities must be appropriate to the context in which the learner is working or will work. Where it is not possible to assess the learner in the workplace or on-the-job, simulations, case studies, role plays and other similar techniques should be used to provide a context appropriate to the assessment.
- > The term "integrated assessment" implies that theoretical and practical components should be assessed together. During integrated assessments, the assessor should make use of a range of summative assessment methods and assess combinations of practical, applied, foundational and reflective competencies.
- > Assessors must assess and give credit for the evidence of learning that has already been acquired and could include formal, non-formal learning and work experience.
- > Assessment should ensure that all specific outcomes, embedded knowledge and critical cross-field outcomes are evaluated in an integrated manner.
- > Integrated assessment instruments may combine practical and theoretical components of assessment with the unit standards in relation to the exit level outcomes.

#### **INTERNATIONAL COMPARABILITY**

The National Certificate: Mechanical Engineering at NQF Level 2 is the first of a learning path of three consecutive qualifications which culminate in the FETC Mechanical Engineering Machining and Tooling at NQF Level 4. The international qualifications found, do not lead to three different qualifications, but culminate in one qualification over a four-year period (in most cases).

It is only in the vocational context, that we find the tendency to "break up" the traditional trades into levels of learning. This practice is endemic of those countries which have a close association with outcomes-based methodology and standards-based qualifications development.

The mechanical engineering qualifications at (NQF Level 2, 3 and 4 respectively) collectively compare well to similar apprenticeship and vocational education and training (VET) international qualifications.

In benchmarking the Mechanical Engineering qualifications at NQF Level 2, 3 and 4, against international qualifications, examples in different parts of the world were investigated for their generic mechanical engineering content (excluding specialised sub-fields):

New Zealand ([www.kiwiquals.govt.nz](http://www.kiwiquals.govt.nz)) in terms of the New Zealand Qualifications Framework (NZQF):

- > National Certificate in Engineering (General Engineering - Mechanical) (Level 2) - Competenz (Training Provider).
- > National Certificate in Mechanical Engineering (Level 2) - Competenz (Training Provider).

Australia ([www.ntis.gov.au](http://www.ntis.gov.au)) in terms of the Australian Quality Training Framework (AQTF):

The following information was obtained on the website: <http://www.ntis.au> (National Information Training System) with regards to qualifications in mechanical engineering training streams in Australia.

"Australian Apprenticeships" is the new name for the scheme formerly known as 'New Apprenticeships'.

Australian Apprenticeships encompass all apprenticeships and traineeships. They combine time at work with training and can be full-time, part-time or school-based.

The change of name and appearance is the first step in a range of improvements to be introduced in Australian Apprenticeships. The qualifications for machining and tooling cover:

- > Certificate I and II Engineering - Mechanical Trade.
- > Certificate II in Production Technology.
- > Certificate III Mechanical Engineering and Technical.
- > Certificate IV Mechanical Engineering.

United Kingdom (England and Scotland) - from [www.ecitb.org.uk](http://www.ecitb.org.uk):

The qualification from the National and Scottish Vocational Qualifications (N/SVQ) which relates to standards-based programme is the N/SVQ Maintaining Plant and Systems - Mechanical. This programme is the closest programme related to the Machining and Tooling Level 2 - 4. It comprises:

- > Maintaining Plant & Systems Mechanical N/SVQ - Mandatory Units.
- > Maintaining Plant & Systems Mechanical N/SVQ - Technical Options Set A.
- > Maintaining Plant & Systems Mechanical N/SVQ - Technical Options Set B.

African Comparability:

Southern African Development Community (SADC) - Zimbabwe and Botswana:

Alignment with the United Kingdom's model of Vocational Education and Training (VET), through the London City and Guilds qualification framework and the National Vocational Qualification system (NVQ) - The Botswana National Qualifications Act was passed in 1998. At this present time, focus on the development of standards-based qualifications through a Botswana Vocation Education and Training System (BVET) has revolved around the Wholesale and Retail and Tourism sectors.

Currently, machinists in Botswana are trained through the apprenticeship system. The length and duration of the practical and theoretical components differ slightly to the South African

apprenticeship system, but the learning competencies are similar, with a focus on the predominant diamond mining and small local manufacturing and engineering industries.

#### East African Community (EAC):

The three member states of the EAC; Kenya, Tanzania and Uganda, are in the process of the harmonisation of education and training systems within the EAC. Currently, no qualification infrastructure exists.

#### Canada:

Information regarding training was also found on the website of the British Columbia Institute of Technology ([www.bcit.ca](http://www.bcit.ca)), the College of The Rockies ([www.cotr.bc.ca](http://www.cotr.bc.ca)) and North Alberta Institute of Technology ([www.nait.ca](http://www.nait.ca)). The full machinists qualification is obtained over a four-year period. The "job description" of the machinists is in essence similar in the international arena.

Machinists produce, repair and maintain all types of machinery and tools".

Conclusion: The Canadian qualifications related to machining can be used interchangeably with the qualifications developed for the South African manufacturing and engineering industries, serving a similar purpose.

#### United States:

In the United States model, the machining qualification is achieved over a four-year period and is similar to the traditional apprenticeship system in South Africa. The methodology is competency-based as opposed to outcomes-based.

The programme content however, is similar to the broad context of Mechanical Engineering Machining and Tooling at NQF Level 2, 3 and 4.

Conclusion: The reviewed machining and tooling qualifications at NQF Level 2, 3 and 4 are in line with the US example for year 1/2 of the apprenticeship programme.

> This type of work requires many different skills. Machinists need to understand how machines work, be able to follow drawings and blueprints, use precision assembly equipment, and calculate angles and measurement.

> They also need to know how to use power tools, cutting torches and demonstrate the ability to weld using a variety of welding processes.

#### Comparisons with National Certificate: Mechanical Engineering at NQF Level 2, 3 and 4

The National Certificate: Mechanical Engineering qualifications compares well to all the qualifications investigated with an overarching comparison covering:

##### > Content:

The qualifications from the various countries all address the range of mechanical competencies included in at NQF Level 2, 3 and 4:

##### > Progression:

The international qualifications all address a progression of competencies, e.g. Introduction to mechanical engineering technology and process and the demonstration of the ability to

assemble, remove and replace components. The content of the first/second year/level of the machining and tooling qualifications across the globe, relates favourably to the content of Mechanical Engineering qualifications and the learning assumed to be in place:

**Demonstrate Work Practices:**

- > Basic training and skills in mechanical engineering technology processes and application of those skills to problems or demonstrate industrial electronic ability.
- > Practice safe work habits.
- > Apply that mechanical knowledge and skills and assist maintenance and/or production teams.
- > Explain federal/provincial/state/territory's occupational health and safety regulations.
- > Explain environmental regulations.
- > Use personal protective equipment.
- > Maintain safe working area.
- > Describe fire prevention and control.
- > Identify ergonomic considerations.
- > Use communication and team skills.
- > Interpret plans and sketches.
- > Use references resources.
- > Describe trade science.
- > Use trade math:
  - > Describe principles of metallurgy.
  - > Use fasteners.
- > Use hand tools:
  - > Use measuring and layout tools and instruments.
  - > Use power tools.
  - > Use fixed shop machines and equipment.
  - > Use mobile equipment.

> Conclusion: These outcomes are covered within the qualifications developed for South Africa.

> Learning delivery: The learning delivery process in all the examples included on-the-job (practical) and off-the-job (theoretical) components.

> Outcomes-Based: All the examples found either directly or indirectly comply with principles of outcomes-based learning, particularly in terms of outcomes representing meaningful units of learning and assessment being conducted continuously (*formatively*). There is generally a final integrated assessment, typically called a trade test, where the candidate is required to demonstrate specific and core (cross-field) knowledge and skills.

> Apprenticeships and VET programmes: In all the examples found, learning is vocational-based. In some countries (England, Scotland, New Zealand and Australia) these are called "modern apprenticeships". These take the form of two categories, namely a programme-led apprenticeship where learners are able to follow a vocational programme at a college and then seek employment as trainees/apprentice/interns in order to qualify as artisans; and an employer-led apprenticeship, in which learners are engaged in a formal contract of learning and most learning is workplace-based. In most cases learners "earn while they learn".

> Application (Purpose): As is the intention with the South African qualifications, the international qualifications all prepare learners for working in process or manufacturing oriented industries where they contribute to the effective and efficient maintenance/ production of plant and equipment.

> Status: In all countries researched, engineering apprenticeship numbers have declined thus making "mechanical fitters" sought after individuals and their skills highly rated.



**Concluding remarks:**

The outcomes of the Mechanical Engineering: Machining and Tooling certificates at NQF Level 2, 3 and 4 developed for South Africa compares favourably with the rest of the international community and by every indication, is compatible with those countries who engage with outcomes-and standards-based qualifications.

**ARTICULATION OPTIONS****Vertical articulation:**

The qualification was designed to enable qualifying learners to move from one engineering context to another and still get recognition for successful learning achievements in the previous context. This means that credit accumulation towards certification could be obtained across industries.

**Horizontal articulation:**

This qualification articulates horizontally with any NQF Level 5 qualification in the broad mechanical, engineering related sectors such as:

- > Metal.
- > Tyre.
- > Auto.
- > Motor.
- > Plastics.
- > Foodbev.
- > Mining.
- > Chemical.
- > Transport.

**MODERATION OPTIONS**

> Anyone assessing a learner or moderating the assessment of a learner against this Qualification must be registered with an appropriate Education and Training Quality Assurance Body (ETQA) or with an ETQA which has a Memorandum of Understanding (MOU) with the relevant ETQA.

> Any institution offering learning that will enable the achievement of this qualification must be accredited as a Training Provider with the relevant ETQA or with an ETQA that has a Memorandum of Understanding (MOU) with the relevant ETQA.

> Moderation of assessment will be overseen by the relevant ETQA or by an ETQA that has a Memorandum of Understanding (MOU) with the relevant ETQA according to that ETQA's guidelines for assessment and moderation.

> Moderation: Includes both internal and external moderation of assessment/s at the exit points of the qualification, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described both in individual unit standards as well as in exit level outcomes described in this Qualification.

**CRITERIA FOR THE REGISTRATION OF ASSESSORS**

The following criteria should be applied by a relevant ETQA as a minimum requirement:

- > Assessors should be in possession of a qualification (or equivalent) in the specific mechanical engineering related discipline and at least 5 years experience in the relevant subject area.
- > Registration as an assessor with the relevant Education and Training Quality Assurance Body.
- > Proven inter-personal skills and the ability to:

- > Maintain national and local industry standards.
- > Act in the interest of the learner.
- > Understand the need for transformation to redress the legacies of the past, and respect the cultural background and language of the learner.

**NOTES**

Completion of this qualification relates to the Organising Framework for Occupations (OFO) in that it reflects the competencies of occupational designation 323204 Metal Machinist (First Class) (Skill level 3).

**UNIT STANDARDS**

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Fundamental	9015	Apply knowledge of statistics and probability to critically interrogate and effectively communicate findings on life related problems	Level 4	6
Fundamental	119462	Engage in sustained oral/signed communication and evaluate spoken/signed texts	Level 4	5
Fundamental	119469	Read/view, analyse and respond to a variety of texts	Level 4	5
Fundamental	9016	Represent analyse and calculate shape and motion in 2- and 3-dimensional space in different contexts	Level 4	4
Fundamental	119471	Use language and communication in occupational learning programmes	Level 4	5
Fundamental	7468	Use mathematics to investigate and monitor the financial aspects of personal, business, national and international issues	Level 4	6
Fundamental	119459	Write/present/sign for a wide range of contexts	Level 4	5
Core	258680	Conduct advanced milling operations and methods	Level 4	16
Core	258677	Conduct complex turning operations	Level 4	16
Core	258676	Grind tools and cutters used in engineering machining operations	Level 4	8
Core	258675	Produce complex components by performing internal and external grinding operations	Level 4	16
Elective	12429	Develop a personal financial plan	Level 3	2
Elective	9506	Communicate in an assertive manner with clients and fellow workers	Level 4	4
Elective	13254	Contribute to the implementation and maintenance of business processes	Level 4	10
Elective	14586	Monitor and control quality control practices in a manufacturing/engineering environment	Level 4	8
Elective	13301	Produce complex engineering drawings	Level 4	6
Elective	13318	Produce components by performing horizontal boring operations	Level 4	12
Elective	13319	Produce components by performing vertical boring operations	Level 4	8
Elective	13320	Set automatic production lathes	Level 4	10
Elective	116389	Write a technical report	Level 4	4
Elective	13315	Write simple computer numerical controlled (CNC) programmes and set and operate a CNC machine	Level 4	24
Elective	12458	Develop the skills of a work team	Level 5	10

**LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION**

None



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:**

***Produce complex components by performing internal and external grinding operations***

SAQA US ID	UNIT STANDARD TITLE		
258675	Produce complex components by performing internal and external grinding operations		
ORIGINATOR		PROVIDER	
SGB Generic Manufacturing, Engineering & Technology			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 4	16

***This unit standard replaces:***

<b>US ID</b>	<b>Unit Standard Title</b>	<b>NQF Level</b>	<b>Credits</b>	<b>Replacement Status</b>
13317	Produce complex components by performing internal and external grinding operations	Level 4	12	Will occur as soon as 258675 is registered

**SPECIFIC OUTCOME 1**

Conduct pre operational checks on grinding machine.

**SPECIFIC OUTCOME 2**

Plan and prepare cylindrical grinding machine.

**SPECIFIC OUTCOME 3**

Perform external and internal cylindrical grinding operations.

**SPECIFIC OUTCOME 4**

Apply quality checks on components.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63629	Further Education and Training Certificate: Mechanical Engineering: Machining and Tooling	Level 4





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Grind tools and cutters used in engineering machining operations*

SAQA US ID	UNIT STANDARD TITLE		
258676	Grind tools and cutters used in engineering machining operations		
ORIGINATOR		PROVIDER	
SGB Generic Manufacturing, Engineering & Technology			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 4	8

*This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13316	Grind tools and cutters used in engineering machining operations	Level 4	8	Will occur as soon as 258676 is registered

**SPECIFIC OUTCOME 1**

Prepare and set machine for grinding activity.

**SPECIFIC OUTCOME 2**

Perform tool and cutter grinding operations.

**SPECIFIC OUTCOME 3**

Apply quality checks on machined tool/cutter.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63629	Further Education and Training Certificate: Mechanical Engineering: Machining and Tooling	Level 4



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Conduct complex turning operations***

SAQA US ID		UNIT STANDARD TITLE	
258677		Conduct complex turning operations	
ORIGINATOR		PROVIDER	
SGB Generic Manufacturing, Engineering& Technology			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 4	16

***This unit standard replaces:***

<b>US ID</b>	<b>Unit Standard Title</b>	<b>NQF Level</b>	<b>Credits</b>	<b>Replacement Status</b>
13314	Produce complex components using lathes	Level 4	20	Will occur as soon as 258677 is registered

**SPECIFIC OUTCOME 1**

Plan and prepare for complex turning operation.

**SPECIFIC OUTCOME 2**

Machine internal and external tapers (matching).

**SPECIFIC OUTCOME 3**

Use accessories for machine tapping and reaming.

**SPECIFIC OUTCOME 4**

Calculate and machine multi start thread.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63629	Further Education and Training Certificate: Mechanical Engineering: Machining and Tooling	Level 4



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Conduct advanced milling operations and methods*

SAQA US ID	UNIT STANDARD TITLE		
258680	Conduct advanced milling operations and methods		
ORIGINATOR	PROVIDER		
SGB Generic Manufacturing, Engineering & Technology			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 4	16

*This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13305	Produce complex components using milling machines	Level 4	29	Will occur as soon as 258680 is registered

**SPECIFIC OUTCOME 1**

Plan and prepare to utilise advanced milling operations and methods.

**SPECIFIC OUTCOME 2**

Cut gears.

**SPECIFIC OUTCOME 3**

Conduct co-ordinated drilling and boring.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

ID	QUALIFICATION TITLE	LEVEL
Core 63629	Further Education and Training Certificate: Mechanical Engineering: Machining and Tooling	Level 4

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Standards Generating Body (SGB) for

**Generic Manufacturing, Engineering and Technology**

registered by Organising Field 06 – Manufacturing, Engineering and Technology, publishes the following Qualification and Unit Standards for public comment.

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the Qualification and Unit Standards. The full Qualification and Unit Standards can be accessed via the SAQA web-site at [www.saqa.org.za](http://www.saqa.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the Qualification and Unit Standards should reach SAQA at the address below and **no later than 5 October 2008**. All correspondence should be marked **Standards Setting – SGB for Generic Manufacturing, Engineering and Technology** and addressed to

The Director: Standards Setting and Development  
SAQA  
*Attention: Mr. D. Mphuthing*  
Postnet Suite 248  
Private Bag X06  
Waterkloof  
0145  
or faxed to 012 – 431-5144  
e-mail: [dmphuthing@saqa.org.za](mailto:dmphuthing@saqa.org.za)

  
**DR. S. BHIKHA**  
**DIRECTOR: STANDARDS SETTING AND DEVELOPMENT**



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**QUALIFICATION:****National Certificate: Mechanical Engineering: Machining and Tooling**

SAQA QUAL ID		QUALIFICATION TITLE	
63649		National Certificate: Mechanical Engineering: Machining and Tooling	
ORIGINATOR		PROVIDER	
SGB Generic Manufacturing, Engineering & Technology			
QUALIFICATION TYPE	FIELD	SUBFIELD	
National Certificate	6 - Manufacturing, Engineering and Technology	Engineering and Related Design	
ABET BAND	MINIMUM CREDITS	NQF LEVEL	QUAL CLASS
Undefined	132	Level 3	Regular-Unit Stds Based

***This qualification does not replace any other qualification and is not replaced by another qualification.***

**PURPOSE AND RATIONALE OF THE QUALIFICATION****Purpose:**

The purpose of the qualification is to provide learners, education and training providers and employers with the standards and the range of learning required to work effectively in various industries making use of engineering machining skills to meet the challenges of such an environment.

The primary skill that is recognised in this qualification is the ability to produce components of some complexity using a variety of machining methods. This capability requires an understanding of advanced machining theory, detailed engineering drawings and a variety of tests and treatments used on engineering metals. Hand skills play a large role in this qualification.

Qualifying learners will be able to maintain and support the various policies and procedures related to the safety, health, environment and quality systems that govern their workplace.

Qualifying learners at NQF Level 3 will be able to:

- > Produce components using simple machining processes to meet operational and output requirements in accordance with legal, health, safety and environmental requirements.
- > Conduct process control activities to ensure quality control and continuous improvement to comply with specifications.
- > Communicate with peers, customers and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format.

**Rationale:**

The qualification addresses needs as identified in the machining disciplines as part of the mechanical engineering sector to ensure that there is a capacity to meet the growth demand of the sector. The mechanical engineering sector broadly refers to manufacturing plants,

processing plant and other industrial operations, ensuring that production efficiencies, plant and machine availability and quality of output are consistently maintained in support of competitiveness. This occupational qualification serves the need of the society and the economy by providing engineering support services in the manufacture and maintenance of machinery, plant and engineering systems in industries such as:

- > Manufacturing and Engineering (Metals, Plastics, Tyre and Rubber, Automotive Manufacturing, Packaging, Capital equipment, Tooling, Agro-processing).
- > Chemical, Petrochemical, Pharmaceuticals.
- > Mining.
- > Transport (Maritime, Road, Rail and Aviation).
- > Civil Engineering and Construction.
- > Food and Beverages.
- > Defence.
- > Energy (generation, transmission, distribution, maintenance, alternative, renewable, domestic).
- > Other engineering-related industry sectors (health, safety).

The industries within these sectors include specific needs related to amongst others:

- > Design.
- > Industrialisation.
- > Manufacturing.
- > Maintenance.
- > Mechanical engineering related information communication technology.

The range of typical learners at this level could include individuals preparing for occupations or trades as:

- > Turners.
- > Tool, jig, mould and die makers.
- > Machinists.

This mechanical engineering qualification provides the learner with the intermediate skills, knowledge and competencies that are required within the machining environment providing a common set of specialisation skills in Machining, Tool, Die, Mould and Jig Making at NQF Level 3. This leads to further specialisations within each of these categories at a NQF Level 4.

This qualification could assist with the achievement of national governmental and industrial development policies and strategies to grow the pool of scarce and other related skills in support of sustainable economic growth. People working in the engineering machining field require specialized technical skills and knowledge, as well as highly developed hand skills in order to adapt to and meet the requirements of the constantly changing products that must be manufactured. Through its design, this qualification will meet the needs of learners within the mechanical engineering sector who require technical expertise and essential knowledge needed to earn formal qualifications. This qualification facilitates access for previously disadvantaged groups and other learners to acquire the technical knowledge and skills that are required as well as provide access and mobility into higher-level more specialised occupations. This will allow the learner greater employability and support the development of small, medium enterprises (SME).

#### **RECOGNIZE PREVIOUS LEARNING?**

Y

#### **LEARNING ASSUMED IN PLACE**

This qualification assumes learners have a national certificate in engineering NQF Level 2 or equivalent.

If the learner does not already have such a qualification, learning in preparation for this qualification would also have to include:

- > Communication at NQF Level 2.
- > Mathematical literacy at NQF Level 2.
- > Science and technology concepts at or equivalent to NQF Level 2.
- > ID 12466: Explain the individual's role within business NQF Level 2.
- > ID 13220: Keep the work area safe and productive, NQF Level 2.
- > ID 12477: Identify engineering materials, their characteristics and applications and common metal tests used in engineering, NQF Level 2.
- > ID 12215: Read, interpret and produce basic engineering drawings, NQF Level 2.
- > ID 12216: Select, use and care for engineering hand tools, NQF Level 2.
- > ID 12476: Select, use and care for engineering measuring equipment, NQF Level 2.
- > ID 9881: Mark off basic regular engineering shapes, NQF Level 2.
- > ID 12219: Select, use and care for engineering power tools, NQF Level 2.
- > ID 253440: Assemble mechanical components, NQF Level 2.
- > ID 13219: Maintain static seals in machines and/or equipment, NQF Level 2.

#### Recognition of Prior Learning:

This qualification can be obtained wholly or in part through the recognition of prior learning (RPL). The learner should be thoroughly briefed on the process. Support and guidance should be provided. The process should not be so onerous as to prevent learners from taking up the RPL option in obtaining the qualification.

#### Access to the Qualification:

- > Open.

#### **QUALIFICATION RULES**

The Fundamental Component which are all compulsory consisting of unit standards in:

- > Communications at Level 3 to the value of 20 credits.
- > Mathematical Literacy at Level 3 to the value of 16 credits.

The Core Component consists of Unit Standards to the value of 63 credits all of which are compulsory.

The Elective Component makes provision for specialisations such as tooling, machining, CNC etc. from which a selection of unit standards to the value of 33 credits can be chosen to make up the total of 132 credits to achieve the qualification. These 33 credits could be chosen as clusters of unit standards from Chemical, Tooling, Machining or any other metal or other industries in order to facilitate specialisations or the registration of learning programmes in specialisation areas.

#### **EXIT LEVEL OUTCOMES**

On completion of this Qualification learners are able to:

1. Produce components using simple machining processes to meet operational and output requirements in accordance with legal, health, safety and environmental requirements.
  - > Range: Simple machining processes includes Single start Internal/External thread; Internal/external taper; Single taper; Counter balancing on face plate; Simple/indirect/direct/angular indexing; Vertical boring; Pitch drilling.



> Range: Operational and output requirements include maintenance, manufacturing, planning, customer, management and quality.

> Note: Produce includes the machining of components for maintenance and/or productions requirements.

2. Conduct process control activities to ensure quality control and continuous improvement to comply with specifications.

3. Communicate with peers, customers and members of supervisory/management levels by demonstrating the ability to gather and summarise information from a range of sources and produce coherent presentations in a prescribed format.

#### Critical Cross Field Outcomes:

The critical cross-field outcomes are supported by the exit level outcomes as follows:

Identifying and solving problems in which responses display that responsible decisions using critical thinking have been made:

- > Related to the application of mechanical technology and skills.
- > In preparation and during the execution of job activities.
- > Solving familiar maintenance problems.

Working effectively with others as a member of a team, group, organization and community:

- > All tasks and work-related experience are performed within a team environment.
- > Taking into account, the safety of others.
- > Communicating with production, quality control and supervisory personnel and/or clients.

Organising and managing oneself and one's activities responsibly and effectively:

- > Related to planning and preparation of machining and tooling tasks.

Collecting, analyzing, organizing and critically evaluating information:

- > Related to planning and preparation in order to execute job activities.
- > Completion of technical reports related to the job activity.
- > Solve familiar problems related to maintenance tasks at hand.

Communicating effectively using visual, mathematical and/or language skills:

- > During planning, preparation and the execution of job activities Completion of technical reports related to the job activity.
- > Communicating effectively by verbal explanation.
- > Communicating as a part of a team.

Using science and technology effectively and critically, showing responsibility towards the environment and health of others when:

- > Understand and explain machining theory and mathematical and scientific concepts underpinning the machining operation.

Demonstrating an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation when:



- > The relationship of the drawing to the final machined component.
- > The manufacturing purpose of the machined component.

### **ASSOCIATED ASSESSMENT CRITERIA**

#### **Associated Assessment Criteria for Exit Level Outcome 1:**

- 1.1 A process plan and an operation sheet are developed in accordance with operational procedures.
  - > Range: Operational procedures relate to sequencing, equipment, speeds and feeds.
- 1.2 Detailed engineering drawings are produced and interpreted in order to manufacture a component in accordance with specified requirements.
- 1.3 Components are produced in accordance with safe working practices reflecting care for fellow workers and the environment.
- 1.4 Maintenance and house keeping activities are undertaken during the production of components.
  - > Range: Maintenance and house keeping activities includes but are not limited to clean machine, component, and tools related to the manufacturing process.
- 1.5 Components are produced in accordance with output requirements.
  - > Range: Output requirements include but are not limited to the process plan, operations sheet and drawing specifications, cost effectiveness, functionality and quality.

#### **Associated Assessment Criteria for Exit Level Outcome 2:**

- 2.1 Inspection methods are selected and applied to determine component compliance with specifications.
- 2.2 Common problems within a machining environment are solved by using appropriate procedures.
  - > Range: Common problems include but are not limited to rough cut, surface finishing, maintaining dimensions, machinery operations, tooling.
- 2.3 Process adjustment requirements are identified in collaboration with team members.
- 2.4 Inspection measurement data are produced, evaluated and presented in accordance with recording requirements.
- 2.5 Process control activities are done within a clearly defined context with some scope for personal decision-making and responsibility.
- 2.6 Process control activities are undertaken reflecting that the output and quality requirements have been met.

#### **Associated Assessment Criteria for Exit Level Outcome 3:**

- 3.1 Information is gathered from a range of sources and accurately summarised into a prescribed format.
- 3.2 Information is clear and accurate and presented in a timely manner in the required format to appropriate parties.
- 3.3 Relationships with peers and supervisory/management levels are established and functioning.
- 3.4 The process and outcomes of the component manufacturing are discussed to reflect technical and non-technical communication skills.
  - > Range: Technical: speeds, feeds, cutter angles, correct materials.
  - > Range: Non-technical: discussion with supervisor/manager, fellow workers and peers, participation in meetings, safety and environment.
- 3.5 The options for further learning in this or a related field of study are discussed to reflect an understanding of further development, specialisations and preparation requirements for such learning.

#### **Integrated Assessment:**

- > Assessment practices must be open transparent fair valid and reliable and should ensure that no learner is disadvantaged in any way whatsoever, so that an integrated approach to assessment is incorporated into the qualification.
- > Learning teaching and assessment are inextricably interwoven. Whenever possible the assessment knowledge skills attitudes and values shown in the unit standards should be integrated.
- > Assessment of Communication and Mathematical Literacy should be integrated as far as possible with other aspects and should use practical administration contexts wherever possible. A variety of methods must be used in assessment and tools and activities must be appropriate to the context in which the learner is working or will work. Where it is not possible to assess the learner in the workplace or on-the-job, simulations, case studies, role plays and other similar techniques should be used to provide a context appropriate to the assessment.
- > The term "integrated assessment" implies that theoretical and practical components should be assessed together. During integrated assessments, the assessor should make use of a range of summative assessment methods and assess combinations of practical, applied, foundational and reflective competencies.
- > Assessors must assess and give credit for the evidence of learning that has already been acquired and could include formal, non-formal learning and work experience.
- > Assessment should ensure that all specific outcomes, embedded knowledge and critical cross-field outcomes are evaluated in an integrated manner.
- > Integrated assessment instruments may combine practical and theoretical components of assessment with unit standards in relation to the exit level outcomes.

### **INTERNATIONAL COMPARABILITY**

The National Certificate: Mechanical Engineering NQF Level 2 is the first of a learning path of three consecutive qualifications which culminate in the Further Education and Training Certificate Mechanical Engineering Machining and Tooling NQF Level 4. The international qualifications found, do not lead to three different qualifications, but culminate in one qualification over a four-year period (in most cases).

It is only in the vocational context, that we find the tendency to "break up" the traditional trades into levels of learning. This practice is endemic of those countries which have a close association with outcomes-based methodology and standards-based qualifications development.

The mechanical engineering qualifications (NQF Level 2, NQF Level 3 and NQF Level 4 respectively) collectively compare well to similar apprenticeship and vocational education and training (VET) international qualifications.

In benchmarking the Mechanical Engineering qualifications at Level 2, Level 3 and Level 4, against international qualifications, examples in different parts of the world were investigated for their generic mechanical engineering content (excluding specialised sub-fields):

New Zealand ([www.kiwiquals.govt.nz](http://www.kiwiquals.govt.nz)) in terms of the New Zealand Qualifications Framework (NZQF):

- > National Certificate in Engineering (General Engineering - Mechanical) (Level 2) - Competenz (Training Provider).
- > National Certificate in Mechanical Engineering (Level 2) - Competenz (Training Provider).

Australia ([www.ntis.gov.au](http://www.ntis.gov.au)) in terms of the Australian Quality Training Framework (AQTF):

The following information was obtained on the website: <http://www.ntis.au> (National Information Training System) with regards to qualifications in mechanical engineering training streams in Australia.

"Australian Apprenticeships" is the new name for the scheme formerly known as 'New Apprenticeships'.

Australian Apprenticeships encompass all apprenticeships and traineeships. They combine time at work with training and can be full-time, part-time or school-based.

The change of name and appearance is the first step in a range of improvements to be introduced in Australian Apprenticeships. The qualifications for machining and tooling cover:

- > Certificate I and II Engineering: Mechanical Trade.
- > Certificate II in Production Technology.
- > Certificate III Mechanical Engineering and Technical.
- > Certificate IV Mechanical Engineering.

United Kingdom (England and Scotland) - from [www.ecitb.org.uk](http://www.ecitb.org.uk):

The qualification from the National and Scottish Vocational Qualifications (N/SVQ) which relates to standards-based programme is the N/SVQ Maintaining Plant and Systems - Mechanical. This programme is the closest programme related to the Machining and Tooling NQF Level 2 - 4. It comprises:

- > Maintaining Plant & Systems Mechanical N/SVQ - Mandatory Units.
- > Maintaining Plant & Systems Mechanical N/SVQ - Technical Options Set A.
- > Maintaining Plant & Systems Mechanical N/SVQ - Technical Options Set B.

African Comparability:

Southern African Development Community (SADC) - Zimbabwe and Botswana:

Alignment with the United Kingdom's model of Vocational Education and Training (VET), through the London City and Guilds qualification framework and the National Vocational Qualification system (NVQ)-The Botswana National Qualifications Act was passed in 1998. At this present time, focus on the development of standards-based qualifications through a Botswana Vocation Education and Training System (BVET) has revolved around the Wholesale and Retail and Tourism sectors.

Currently, machinists in Botswana are trained through the apprenticeship system. The length and duration of the practical and theoretical components differ slightly to the South African apprenticeship system, but the learning competencies are similar, with a focus on the predominant diamond mining and small local manufacturing and engineering industries.

East African Community (EAC):

The three member states of the EAC; Kenya, Tanzania and Uganda, are in the process of the harmonisation of education and training systems within the EAC. Currently, no qualification infrastructure exists.

Canada:

Information regarding training was also found on the website of the British Columbia Institute of Technology ([www.bcit.ca](http://www.bcit.ca)), the College of The Rockies ([www.cotr.bc.ca](http://www.cotr.bc.ca)) and North Alberta Institute of Technology ([www.nait.ca](http://www.nait.ca)). The full machinists qualification is obtained over a four-year period. The "job description" of the machinists is in essence similar in the international arena. Machinists produce, repair and maintain all types of machinery and tools".

**Conclusion:** The Canadian qualifications related to machining can be used interchangeably with the qualifications developed for the South African manufacturing and engineering industries, serving a similar purpose.

**United States:**

In the United States model, the machining qualification is achieved over a four-year period and is similar to the traditional apprenticeship system in South Africa. The methodology is competency-based as opposed to outcomes-based.

The programme content however, is similar to the broad context of Mechanical Engineering Machining and Tooling Levels 2, 3 and 4.

**Conclusion:** The reviewed machining and tooling qualifications NQF Level 2, NQF Level 3 and NQF Level 4 are in line with the US example for year 1/2 of the apprenticeship programme.

> This type of work requires many different skills. Machinists need to understand how machines work, be able to follow drawings and blueprints, use precision assembly equipment, and calculate angles and measurement.

> They also need to know how to use power tools, cutting torches and demonstrate the ability to weld using a variety of welding processes.

Comparisons with National Certificate Mechanical Engineering NQF Level 2, NQF Level 3 and NQF Level 4.

The National Certificate Mechanical Engineering qualifications compares well to all the qualifications investigated with an overarching comparison covering:

> **Content:**

The qualifications from the various countries all address the range of mechanical competencies included in NQF Level 2, NQF Level 3 and NQF Level 4.

> **Progression:**

The international qualifications all address a progression of competencies, e.g. Introduction to mechanical engineering technology and process and the demonstration of the ability to assemble, remove and replace components. The content of the first/second year/level of the machining and tooling qualifications across the globe, relates favourably to the content of Mechanical Engineering qualifications and the learning assumed to be in place:

**Demonstrate Work Practices:**

- > Basic training and skills in mechanical engineering technology processes and application of those skills to problems or demonstrate industrial electronic ability.
- > Practice safe work habits.
- > Apply that mechanical knowledge and skills and assist maintenance and/or production teams:
  - > Explain federal/provincial/state/territory's occupational health and safety regulations.
  - > Explain environmental regulations.
  - > Use personal protective equipment.
  - > Maintain safe working area.
  - > Describe fire prevention and control.
  - > Identify ergonomic considerations.
  - > Use communication and team skills.
  - > Interpret plans and sketches.

- > Use references resources.
- > Describe trade science.
- > Use trade math:
  - > Describe principles of metallurgy.
  - > Use fasteners.
  - > Use hand tools.
  - > Use measuring and layout tools and instruments.
  - > Use power tools.
  - > Use fixed shop machines and equipment.
  - > Use mobile equipment.
- > Conclusion: These outcomes are covered within the qualifications developed for South Africa.
- > Learning delivery: The learning delivery process in all the examples included on-the-job (practical) and off-the-job (theoretical) components.
- > Outcomes-Based: All the examples found either directly or indirectly comply with principles of outcomes-based learning, particularly in terms of outcomes representing meaningful units of learning and assessment being conducted continuously (formatively). There is generally a final integrated assessment, typically called a trade test, where the candidate is required to demonstrate specific and core (cross-field) knowledge and skills.
- > Apprenticeships and VET programmes: In all the examples found, learning is vocational-based. In some countries (England, Scotland, New Zealand and Australia) these are called "modern apprenticeships". These take the form of two categories, namely a programme-led apprenticeship where learners are able to follow a vocational programme at a college and then seek employment as trainees/apprentice/interns in order to qualify as artisans; and an employer-led apprenticeship, in which learners are engaged in a formal contract of learning and most learning is workplace-based. In most cases learners "earn while they learn".
- > Application (Purpose): As is the intention with the South African qualifications, the international qualifications all prepare learners for working in process or manufacturing oriented industries where they contribute to the effective and efficient maintenance/ production of plant and equipment.
- > Status: In all countries researched, engineering apprenticeship numbers have declined thus making "mechanical fitters" sought after individuals and their skills highly rated.

#### Concluding remarks:

The outcomes of the Mechanical Engineering: Machining and Tooling certificates at NQF Level 2, NQF Level 3 and NQF Level 4 developed for South Africa compares favourably with the rest of the international community and by every indication, is compatible with those countries who engage with outcomes-and standards-based qualifications.

#### **ARTICULATION OPTIONS**

The qualification was designed to enable qualifying learners to move from one engineering context to another and still get recognition for successful learning achievements in the previous context. This means that credit accumulation towards certification could be obtained across industries.

#### Vertical articulation:

- > ID 23279: Further Education and Training Certificate: Mechanical Engineering: Machining NQF Level 4.
- > ID 57885: Further Education and Training Certificate: CNC Production Machining.



> ID 63629: Further Education and Training Certificate: Mechanical Engineering: Fitting NQF Level 4.

Horizontal articulation:

> Fundamental learning at this level applies to equivalent credit accrual for engineering-related qualifications at NQF Level 3.

Core learning at this level applies to equivalent credit accrual for some unit standards in the following qualifications:

> ID 22423: National Certificate: Engineering and Related Design NQF Level 3.

> ID 58720: National Certificate: Engineering Fabrication NQF Level 3.

> ID 59669: National Certificate: Mechanical Engineering: Fitting NQF Level 3.

> ID 57886: National Certificate: Welding Application and Practice NQF Level 3.

Other horizontal articulation options may exist and need further investigation in cases where recognition of prior learning is sought.

#### **MODERATION OPTIONS**

> Anyone assessing a learner or moderating the assessment of a learner against this Qualification must be registered with an appropriate Education and Training Quality Assurance Body (ETQA) or with an ETQA which has a Memorandum of Understanding (MOU) with the relevant ETQA.

> Any institution offering learning that will enable the achievement of this qualification must be accredited as a Training Provider with the relevant ETQA or with an ETQA that has a Memorandum of Understanding (MOU) with the relevant ETQA.

> Moderation of assessment will be overseen by the relevant ETQA or by an ETQA that has a Memorandum of Understanding (MOU) with the relevant ETQA according to that ETQA's guidelines for assessment and moderation.

> Moderation, includes both internal and external moderation of assessment/s at the exit points of the qualification, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described both in individual unit standards as well as in exit level outcomes described in this Qualification.

#### **CRITERIA FOR THE REGISTRATION OF ASSESSORS**

The following criteria should be applied by a relevant ETQA as a minimum requirement:

> Assessors should be in possession of an appropriate qualification:

> Mechanical Engineering in the specific discipline at NQF Level 4 and a minimum period of 5 years related experience as specified by the relevant ETQA.

Or

> An artisan qualification in Mechanical Engineering in the specific discipline (Trade test certificate or completed contract of apprenticeship) with a minimum of 5 years of related experience as specified by the relevant ETQA.

Or

> Subject matter experience, which may be established through recognition of prior learning (RPL).

> Registration as an assessor with the relevant Education and Training Quality Assurance Body.

> Proven inter-personal skills and the ability to:

> Maintain national and local industry standards.

- > Act in the interest of the learner.
- > Understand the need for transformation to redress the legacies of the past, and respect the cultural background and language of the learner.

**NOTES**

Completion of this qualification relates to the Organising Framework for Occupations (OFO) in that it reflects the competencies of occupational designation 711 Machine Operator.

**UNIT STANDARDS**

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	119472	Accommodate audience and context needs in oral/signed communication	Level 3	5
Fundamental	9010	Demonstrate an understanding of the use of different number bases and measurement units and an awareness of error in the context of relevant calculations	Level 3	2
Fundamental	9013	Describe, apply, analyse and calculate shape and motion in 2-and 3-dimensional space in different contexts	Level 3	4
Fundamental	119457	Interpret and use information from texts	Level 3	5
Fundamental	9012	Investigate life and work related problems using data and probabilities	Level 3	5
Fundamental	119467	Use language and communication in occupational learning programmes	Level 3	5
Fundamental	7456	Use mathematics to investigate and monitor the financial aspects of personal, business and national issues	Level 3	5
Fundamental	119465	Write/present/sign texts for a range of communicative contexts	Level 3	5
Core	9526	Manage basic business finance	Level 3	6
Core	9530	Manage work time effectively	Level 3	3
Core	258716	Produce components by performing engineering grinding operations	Level 3	12
Core	258718	Produce components by performing milling operations	Level 3	16
Core	258717	Produce components by performing turning operations	Level 3	20
Core	13298	Produce detailed engineering drawings	Level 3	6
Elective	115091	Monitor compliance to safety, health and environmental requirements in a workplace	Level 2	2
Elective	244611	Apply problem-solving techniques to make a decision or solve a problem in a real life context	Level 3	2
Elective	13234	Apply quality procedures	Level 3	8
Elective	12488	Complete feasibility and commissioning reports	Level 3	3
Elective	12457	Develop learning strategies and techniques	Level 3	3
Elective	14688	Develop work instructions for thermoplastic fabrication using drawings	Level 3	10
Elective	12456	Explain and use organisational procedures	Level 3	6
Elective	116218	Explain the planning and scheduling of tasks in a production environment	Level 3	3
Elective	258722	Maintain and repair production tooling	Level 3	16
Elective	258723	Manufacture production tooling to drawing or sample part	Level 3	24
Elective	243025	Monitor machining process, interpret statistical process control charts, and rectify production problems	Level 3	7
Elective	8039	Operating cranes	Level 3	10
Elective	8038	Operating lift trucks	Level 3	6
Elective	13275	Perform heat treatment processes on engineering metals	Level 3	8
Elective	13260	Perform non-destructive tests on metal parts and components	Level 3	6
Elective	117877	Perform one-to-one training on the job	Level 3	4
Elective	258715	Produce components by spark eroding machining operations	Level 3	8
Elective	120383	Provide assistance in implementing and assuring project work meets quality requirements	Level 3	6
Elective	243024	Set up and start CNC machining processes	Level 3	14
Elective	13274	Test the physical properties of engineering metals	Level 3	4
Elective	114978	Use a word processing package to produce business documents	Level 3	3
Elective	119169	Work with and look after materials in the plastics manufacturing production process	Level 3	12

***LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION******None***





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Produce components by spark eroding machining operations*

SAQA US ID	UNIT STANDARD TITLE		
258715	Produce components by spark eroding machining operations		
ORIGINATOR	PROVIDER		
SGB Generic Manufacturing, Engineering & Technology			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	8

*This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13255	Produce components by spark eroding machining operations	Level 3	8	Will occur as soon as 258715 is registered

**SPECIFIC OUTCOME 1**

Plan and prepare spark eroding machine.

**SPECIFIC OUTCOME 2**

Machine electrode.

**SPECIFIC OUTCOME 3**

Perform spark eroding operations.

**SPECIFIC OUTCOME 4**

Apply quality checks on component.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63649	National Certificate: Mechanical Engineering: Machining and Tooling	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Produce components by performing engineering grinding operations*

SAQA US ID	UNIT STANDARD TITLE		
258716	Produce components by performing engineering grinding operations		
ORIGINATOR		PROVIDER	
SGB Generic Manufacturing, Engineering & Technology			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	12

*This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13294	Produce components by performing engineering grinding operations	Level 3	12	Will occur as soon as 258716 is registered

**SPECIFIC OUTCOME 1**

Explain and discuss surface grinding processes.

**SPECIFIC OUTCOME 2**

Grind work piece square.

**SPECIFIC OUTCOME 3**

Grind angles.

**SPECIFIC OUTCOME 4**

Grind component on cylindrical grinding machine.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63649	National Certificate: Mechanical Engineering: Machining and Tooling	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Produce components by performing turning operations*

SAQA US ID	UNIT STANDARD TITLE		
258717	Produce components by performing turning operations		
ORIGINATOR	PROVIDER		
SGB Generic Manufacturing, Engineering & Technology			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	20

*This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13295	Produce components by performing engineering turning operations	Level 3	20	Will occur as soon as 258717 is registered

**SPECIFIC OUTCOME 1**

Explain and discuss turning operations.

**SPECIFIC OUTCOME 2**

Prepare for turning operations and maintain lathe.

**SPECIFIC OUTCOME 3**

Perform turning operations.

**SPECIFIC OUTCOME 4**

Finish turning operation.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63649	National Certificate: Mechanical Engineering: Machining and Tooling	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Produce components by performing milling operations*

SAQA US ID	UNIT STANDARD TITLE		
258718	Produce components by performing milling operations		
ORIGINATOR		PROVIDER	
SGB Generic Manufacturing, Engineering & Technology			
FIELD		SUBFIELD	
6 - Manufacturing, Engineering and Technology		Manufacturing and Assembly	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	16

*This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13296	Produce components by performing engineering milling operations	Level 3	20	Will occur as soon as 258718 is registered

**SPECIFIC OUTCOME 1**

Explain and discuss milling operations.

**SPECIFIC OUTCOME 2**

Prepare for milling operations and maintain milling machine.

**SPECIFIC OUTCOME 3**

Perform milling operations.

**SPECIFIC OUTCOME 4**

Finish milling operation.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63649	National Certificate: Mechanical Engineering: Machining and Tooling	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Maintain and repair production tooling*

SAQA US ID	UNIT STANDARD TITLE		
258722	Maintain and repair production tooling		
ORIGINATOR	PROVIDER		
SGB Generic Manufacturing, Engineering & Technology			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	16

*This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13257	Maintain and repair production tooling	Level 3	20	Will occur as soon as 258722 is registered

**SPECIFIC OUTCOME 1**

Discuss and explain the procedures in the maintenance and repair of production tooling.

**SPECIFIC OUTCOME 2**

Dismantle tooling components.

**SPECIFIC OUTCOME 3**

Identify and analyse defects in tooling.

**SPECIFIC OUTCOME 4**

Manufacture/repair tooling components in accordance with legal and safety requirements.

**SPECIFIC OUTCOME 5**

Conduct sample try-out.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63649	National Certificate: Mechanical Engineering: Machining and Tooling	Level 3



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Manufacture production tooling to drawing or sample part*

SAQA US ID	UNIT STANDARD TITLE		
258723	Manufacture production tooling to drawing or sample part		
ORIGINATOR	PROVIDER		
SGB Generic Manufacturing, Engineering & Technology			
FIELD	SUBFIELD		
6 - Manufacturing, Engineering and Technology	Manufacturing and Assembly		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 3	24

*This unit standard replaces:*

US ID	Unit Standard Title	NQF Level	Credits	Replacement Status
13259	Manufacture production tooling to drawing or sample part	Level 3	36	Will occur as soon as 258723 is registered

**SPECIFIC OUTCOME 1**

Plan and prepare for tooling manufacturing process.

**SPECIFIC OUTCOME 2**

Manufacture production tooling.

**SPECIFIC OUTCOME 3**

Test tool in accordance to drawing specifications.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63649	National Certificate: Mechanical Engineering: Machining and Tooling	Level 3

No. 921

5 September 2008

**SOUTH AFRICAN QUALIFICATIONS AUTHORITY (SAQA)**

In accordance with Regulation 24(c) of the National Standards Bodies Regulations of 28 March 1998, the Standards Generating Body (SGB) for

**Geographical Information Sciences**

registered by Organising Field 12, Physical Planning and Construction, publishes the following *Qualification and Unit Standards for public comment.*

This notice contains the titles, fields, sub-fields, NQF levels, credits, and purpose of the Qualification and Unit Standards. The full Qualification and Unit Standards can be accessed via the SAQA web-site at [www.saqa.org.za](http://www.saqa.org.za). Copies may also be obtained from the Directorate of Standards Setting and Development at the SAQA offices, SAQA House, 1067 Arcadia Street, Hatfield, Pretoria.

Comment on the Qualification and Unit Standards should reach SAQA at the address below and ***no later 5 October 2008***. All correspondence should be marked **Standards Setting – Geographical Information Sciences** addressed to

The Director: Standards Setting and Development  
SAQA

*Attention: Mr. D. Mphuthing*

Postnet Suite 248

Private Bag X06

Waterkloof

0145

or faxed to 012 – 431-5144

e-mail: [dmphuthing@saqa.org.za](mailto:dmphuthing@saqa.org.za)

**DR S BHIKHA**

**DIRECTOR: STANDARDS SETTING AND DEVELOPMENT**





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

### QUALIFICATION:

#### *National Diploma: Geographical Information Science*

SAQA QUAL ID	QUALIFICATION TITLE		
63589	National Diploma: Geographical Information Science		
ORIGINATOR	PROVIDER		
SGB Geographical Information Sciences			
QUALIFICATION TYPE	FIELD	SUBFIELD	
National Diploma	12 - Physical Planning and Construction	Physical Planning, Design and Management	
ABET BAND	MINIMUM CREDITS	NQF LEVEL	QUAL CLASS
Undefined	240	Level 5	Regular-Unit Stds Based

*This qualification does not replace any other qualification and is not replaced by another qualification.*

### PURPOSE AND RATIONALE OF THE QUALIFICATION

#### Purpose:

This qualification is aimed at learners who work or intend to work in the Geographical Information Science (GISc) occupational area as systems Technicians or related occupational fields and who seek recognition for essential skills in the conduct of GIS. The qualification will also be valuable for those who may have been practising within the GIS sector, but without formal recognition.

This qualification has been developed to assist with professional advancement across the GISc industry. This will allow learners to register as systems Technicians in the Geo-informatics field and lay a foundation for future career advancement in this learning area.

On achieving this qualification a learner will be able to:

- > Collect, capture and exchange data from various formats and sources.
- > Manipulate and visualise data to meet the stated requirement.
- > Manage a database to store the required data sets and develop simple SQL queries.
- > Operate effectively as a GISc Technician in a professional practise.

#### Rationale:

The introduction of a National Diploma in GISc based on unit standards will allow learners to enter the occupational area as Geographical Information Systems (GIS) Technicians and to reach full potential of advancement without formal education becoming an impassable barrier and in addition, allow for the recognition of prior learning.

This Qualification represents a planned combination of learning outcomes with a defined purpose in that they consist of the essential theory and applied competence required by the GISc profession and those learners who seek to be recognised by the profession for formal qualifications and registration as a GISc practitioner.

This Qualification is accessible to learners' who are employed within the Construction Industry, new entrants into the world of work and persons who are unemployed.

**RECOGNIZE PREVIOUS LEARNING?**

Y

**LEARNING ASSUMED IN PLACE**

- > Communication at NQF Level 4.
- > Mathematics at NQF Level 4.
- > Geography at NQF Level 4.
- > Computer literacy at NQF Level 3.

Recognition of Prior Learning:

This qualification can be achieved wholly or in part through recognition of prior learning in terms of the defined exit level outcomes and/or individual unit standards.

Evidence can be presented in various ways, including international and/or previous local qualifications, products, reports, testimonials mentioning functions performed, work records, portfolios, videos of practice and performance records.

All such evidence will be judged in accordance with the general principles of assessment described above and the requirements for integrated assessment.

Access to the Qualification:

Access to this qualification is free bearing in mind learning assumed to be in place.

**QUALIFICATION RULES**

This qualification is made up of a combination of learning outcomes from Fundamental, Core and Elective components, totalling 240 credits.

- > Fundamental components: It consists of unit standards totalling 46 credits.
- > Core component: It is made up of unit standards totalling 159 credits. All unit standards in this section are compulsory.
- > Elective component: The learners are expected to choose a minimum of 35 credits from the Elective to achieve minimum total credits of 240 in order to be awarded this qualification.

**EXIT LEVEL OUTCOMES**

1. Collect and capture data under supervision from various formats and sources.
2. Manipulate and visualise the data under supervision to meet the stated requirement.
3. Manage a database to store the required data sets and develop simple SQL queries.
4. Operate effectively as a GISc Technician in a professional practise.

Critical Cross-Field Outcome:

This qualification promotes, in particular, the following Cross-Field Outcomes:

Ability to solve problems:

- > When analysing data in order to make informed decisions.
- > When managing projects according to specifications, while meeting dead lines and budget constraints.

Work effectively with others as a member of a team/group/organisation or community:

- > When sourcing data from different custodians.
- > When analysing data and assist users to make informed decisions.
- > When managing team members to achieve optimal performance.

Organise and manage oneself and one's activities responsibly and effectively:

- > When performing the work in accordance with industry standards.
- > When managing projects according to specifications, while meeting dead lines and budget constraints.
- > When sourcing and managing data from different custodians.

Collect, organise and critically evaluate information:

- > When complying with user need requirements.
- > When analysing data and assist users to make informed decisions.
- > When managing projects according to specifications, while meeting dead lines and budget constraints.

Communicate effectively using visual, Mathematics and language skills in the modes of oral and written presentations:

- > When analysing data and assist users to make informed decisions.
- > When managing projects according to specifications, while meeting dead lines and budget constraints.
- > When providing metadata for data sets.
- > Use science and technology effectively and critically (showing responsibility towards the environment and health of others):
- > When analysing data and assist users to make informed decisions.
- > When managing projects according to specifications, while meeting dead lines and budget constraints.
- > When using the appropriate technology and tools in consideration of environmental constraints.

Demonstrate an understanding of the world as a set of related systems:

- > The inter-relatedness when applying knowledge and technology regarding spatially related entities in problem solving.

#### **ASSOCIATED ASSESSMENT CRITERIA**

Associated Assessment Criteria for Exit Level Outcome 1:

- > Digital data files in different physical formats are imported into the dataset.
- > Data sets in different co-ordinate systems are transformed into an appropriate target co-ordinate system.
- > Source data at different levels of accuracy, currency and scale are manipulated for the target data set.
- > Data are collected from various data sources.
- > Meta data should be included in all data sets.

Range: Sources: Including but not limited to Government and private data providers, Internet, other systems (e.g. financial data), paper maps, multi-spectral satellite imagery and aerial photography, alphanumeric data, digitizing.

**Associated Assessment Criteria for Exit Level Outcome 2:**

- > A given dataset is analysed to assist the end user in making an informed decision.
- > Data is symbolised in a way, which will allow for visual interpretation and decision-making.

**Associated Assessment Criteria for Exit Level Outcome 3:**

- > A database is managed to facilitate results.
- > Database is populated with batch importing and single record capturing.
- > Data is captured in an accurate and consistent manner.
- > Data is analysed and queried in an effective way to assist in decision making.
- > Relevant data is backed up to enable restoration of data in the case of any data loss.

**Associated Assessment Criteria for Exit Level Outcome 4:**

- > Projects are managed according to specification, on time and within budget.
- > Ethical principles are applied in all decisions.
- > Team members are co-operated with in such a way that optimal performance is achieved.

**Integrated Assessment:**

Integrated assessment provides learners with an opportunity to display an ability to integrate practical performance, actions, concepts and theory across unit standards to achieve competence in relation to the purpose of this qualification.

**Assessment shall:**

- > Measure the quality of the observed practical performance as well as the theory and underpinning knowledge behind it.
- > Use methods that are varied to allow the learner to display thinking and decision making in the demonstration of practical performance.
- > Maintain a balance between practical performance and theoretical assessment methods to ensure each is measured in accordance with the level of the qualification.
- > The relationship between practical and theoretical is not fixed but varies according to the type and level of qualification.

**INTERNATIONAL COMPARABILITY**

Extensive International comparability was conducted with various countries and the following countries were chosen because of their best practise.

**Australia:**

**Queensland University of Technology:**

**Graduate Diploma in Geographic Information Systems:**

- > Remote Sensing.
- > Geographic Information Systems.
- > Topics in Spatial Information Science.
- > Specialisation.

**Potential Careers:**

> Geologist, Mapping Scientist/Photogrammetrist, Surveyor.

**Topics in Spatial Information Science:****Remote Sensing:**

This unit includes the following:

> History and principals of remote sensing; types of imagery, image interpretation, satellite systems; supervised and unsupervised image classification; interpretation, analysis and presentation of data; applications in the earth sciences.

**Specialisation:**

This unit ensures personalised study that supports the student's elected specialisation and contributes directly to the better understanding of the research project topic. Students undertake study to develop specialised knowledge and skills related to the specific specialisation and to support the direction of the proposed research project topic. Study is taken from specific programs offered by the School, or from advanced units within the University or, where appropriate, through another university or through specialist studies offered by staff in their areas of expertise and approved by the Head of School on the recommendation of the student's supervisor.

**Geographic Information Systems:**

This unit investigates the basic concepts of geographic information systems. Topics to be covered include components of GIS, spatial databases, data acquisition, reference frameworks, use of photographs and images, spatial analysis and graphic output design issues. The unit will highlight the importance of geographic information systems the unit will highlight the importance of geospatial positioning applications in society.

**USA:**

Northwest Missouri State University offers a Master of Science degree in Geographic Information Science. The program includes courses on modelling with GIS, Geostatics, Cartographic design, GIS database design and project management.

**University at Buffalo:**

The University at Buffalo offers a doctoral degree concentration in Geographic Information Science - an emerging interdisciplinary field that incorporates innovative research in environmental science, social science, information science, and engineering. The goal of the program is to prepare Ph.D. students with the interdisciplinary background and the technical, professional and personal skills needed for careers in Geographic Information Science. Students in the GI Science concentration at the University at Buffalo take a core of courses in GI Science, while also completing requirements for doctorates in any of the seven discipline-based departments.

GI Science students obtain research training through individualized faculty mentoring, and participate in active research programs under three broad themes: Geographic Information Science, Geographic Environmental Science, and Geographic Social Science. Students also gain a wealth of practical experience through internships, international opportunities, and participation in workshops, conferences, and fieldwork. By awarding degrees in traditional disciplines, while having an inherently interdisciplinary curriculum, the GI Science Concentration

allows students to combine an innovative program of study suited to our rapidly changing world with the solid credentials of an established doctoral degree.

Curtin University of Technology:

Curtin offers a wide range of master and doctoral degrees by research. To qualify as a research degree, at least two-thirds of the required work for the award must be research. The award of a Master's (by Research) or a PhD indicates that a student has contributed substantially to the knowledge or understanding in a field, and is capable of carrying out independent research.

University of Dallas:

To receive the PhD in Geospatial Information Sciences, students must complete the Geospatial Science Core (15 SCH) to achieve a mastery of GI Science technologies and theory, have a Geospatial Specialization Area (15 SCH), have a Specific Application area or Technical field (12 SCH), evidence research skills through successful completion and defense of a Ph. D. dissertation, and take related electives as necessary for a total of 90 semester credit hours. In addition, students must satisfy a set of exams and qualifiers. Other courses may be substituted for those listed below with the written permission in advance of the Director of the GIS Doctoral program.

Geospatial Science Core (15 credit hours):

- > GIS Fundamentals.
- > Applied GIS.
- > Spatial Analysis and Modeling.
- > GIS Theories, Models and Issues.
- > Geographic Information Systems Workshop.

Geospatial Specialization Area (select from one, with a minimum of 15 credit hours):

Geospatial Computing and Information Management:

- > Advanced Operating Systems.
- > Object Oriented Analysis and Design.
- > Database Design.
- > Spatial Data Management.
- > Artificial Intelligence.
- > Computer Graphics.
- > Computer Vision.
- > Combinatorics and Graph Algorithms.
- > Neural Nets and Machine Learning.
- > GIS Management and Implementation.
- > Internet Mapping and Information Management.
- > GIS Application Development.
- > Database Management Systems.

Spatial Analysis and Modeling:

- > Descriptive and Inferential Statistics.
- > Advanced Regression Analysis.
- > Econometrics.
- > GIS Pattern Analysis.
- > Spatial Statistics.
- > GIS Network Modeling.



- > Demographic Analysis and Modeling.
- > Spatial Epidemiology.
- > Data Analysis for Geoscientists.
- > Advanced Raster Modeling.
- > Data Structures.

**Remote Sensing and Satellite Technologies:**

- > Intro to Remote Sensing.
- > Applied Remote Sensing.
- > Remote Sensing Digital Image Processing.
- > Radar Remote Sensing.
- > GPS Satellite Surveying Techniques.
- > GIS Applications to Geosciences.
- > Remote Sensing Workshop.
- > Digital Signal Processing.
- > Digital Image Processing.

**Customized Geospatial Specialization.**

Identified by the student with approval in advance by the Director of the GIS Doctoral Program.

**Application Area or Technical Field (12 SCH):**

Twelve semester-credit hours of specialized course work in an application area or technical field relevant to GIScience. Normally, these will derive from the student's masters degree. These hours may be transferred from another institution, or taken at UTD in an existing master's program area and may be applied toward a master's in that area:

Technical field examples: statistics, computer science, software engineering, management information systems, image analysis, operations research, instrumentation, etc.

**Research and Dissertation (24-48 credit hours which could include):**

- > GIS PhD Research Qualifier.
- > Research Design I.
- > Research Design II.
- > GIS Research Design.
- > Research in GIS.
- > Geoscience Presentations.
- > Dissertation.
- > Other Related Electives (0-24 credit hours).
- > GIS: Geospatial Information Sciences.
- > CS: Computer Science.
- > GEOS: Geoscience.
- > MIS: Management Information Systems.

**Ph.D. Research Project Qualifier:**

All doctoral students must register for and complete GISciences PhD Research Project Qualifier. This requires completion, according to uniform guidelines established by the GIS program, of a GIS Research draft proposal and its evaluation by a committee of at least three GIS faculty, two of whom are chosen by the student with approval of the Director of the GIS Doctoral Program, and the third is appointed by the Director of the GIS Program and represents the program. The committee will judge the quality of the project as it exemplifies the student's potential to conduct



original research (including their ability to define their research objective, survey literature, develop an appropriate design, etc) and the strength of the student's course record to date, and make a determination of the student's suitability to continue toward the PhD degree. The student must receive a PASS. If a FAIL is recorded, the course may be repeated one time only in the immediate following semester, including Summer. This course will normally be taken after the student has completed between 15 and 30 hours. A student must register for GISC 7389 in the semester immediately following the one in which he/she first accumulates 42 or more hours. GISC 7389 GIScience Research Project Qualifier can substitute for GISC 6389 GIScience Master's Project, but not the reverse unless a special petition is presented and granted.

United Kingdom:

University of Edinburgh:

(Honours):

Year 1:

- > Plane Surveying.
- > Information Technology.
- > Quantitative Methods.
- > Mapping (including field scheme).
- > Introduction to GIS.
- > Applications in GIS.

Year 2:

- > Applied Information Technology.
- > Data Acquisition and 3D Modelling.
- > Legal Framework for Geomatics.
- > Handling Spatial Data.
- > Analysing Spatial Data.
- > Digital Cartography.

Year 3:

- > Dissertation.
- > Management Studies in Geomatics.
- > Professional Studies in Geomatics.
- > Options - choice of two (there may be timetable implications).
- > Geographical Information Management.
- > Spatial Data Analysis.
- > Integrated Water Management.
- > Information Technology Applications.
- > Cadastre and Land Administration.

You will have a mixture of timetabled classes and dedicated.

Kingston University London:

BSC. Honours:

Year 1:

- > Introduction to GIS 1.

- > GIS Techniques 2.
- > Applications of Geo-Analysis 3.
- > Mathematics and Statistics.
- > Sustainable Development: Issues and Concepts.
- > Investigating the Earth and Environment I.
- > Investigating the Earth and Environment II.
- > Understanding the Environment.

Year 2:

- > Geographical Analysis and Modelling 4.
- > GIS Enterprise and Research 5.
- > Spatial Databases 6.
- > GIS Software Development 7.
- > Remote Sensing and Image Processing 8.
- > Digital Mapping 9.
- > Geodemographic Analysis 10.
- > Mobile GIS (overseas fieldwork) 11.

Year 3:

- > Contemporary Issues in GIS 12.
- > Geo-visualisation 13.
- > Crime Patterns and the Environment 14.
- > Systems Analysis and Design.
- > Applications of Remote Sensing 15.
- > Land Information Systems 16.
- > Geodemographic Analysis 10.
- > GIS and hazards 17.
- > GIS Dissertation (double) 18.
- > GIS Dissertation (single).
- > Water Resources Management.
- > Ecology and Conservation in Temperate Ecosystems.
- > Geography of Recreation and Tourism.
- > Global Environments: Strategic Assessment (overseas fieldwork).

Geographical Information Systems (GIS) MSc programmes:

Postgraduate GIS courses at Kingston:

There are two MSc programmes in Geographical Information Systems (GIS) at Kingston:

- > Applied Geographical Information Systems MSc - a mixed mode course with an 'applications' focus, which is taught partly by distance learning and partly in class.
- > Geographical Information Systems and Science MSc - taught entirely by distance learning using our online course materials (due to start in September 2008 subject to validation).

The two MSc programmes in GIS both operate within Kingston University's modular course system, each comprising eight taught modules and a research project. The courses have been designed to provide a flexible learning environment to suit all needs, whether you prefer face-to-face contact or are currently in employment and wish to take a non-contact course to study in your own time.

What does one study?

The MSc GIS programmes at Kingston University provide the high quality education needed to meet the needs of users of geotechnology or those seeking to enter a career in GIS. Students will gain a high level of competency in the principles of GI Science and the use of geotechnology; they will be able to routinely use professional software for data acquisition, handling, exploration and mapping.

Knowledge and skills in spatial analysis and spatial databases will provide students with the skills to develop GIS in addition to working with GIS in a range of environments for crime mapping, health analysis, hurricane prediction, 3d modelling and animation and many more.

The MSc GIS programmes have a number of key overarching features. You will:

- > Develop a knowledge and understanding of the principles of GI science and the use of geotechnology.
- > Understand the conceptual foundations of geographical information handling.
- > Effectively handle spatial entities for data transformations, generalisation and aggregation.
- > Develop competency in analytical operations, methods and spatial analyses.
- > Effectively implement principles of map design and graphical representation techniques.
- > Understand spatial database systems and application design.
- > Perform storage and retrieval operations, work with alternative data models, 3d modelling and advanced visualisation.
- > Explore the role of GIS in society including organisational and institutional aspects.
- > Study a range of themes in geography and environmental science.
- > Prepare yourself for employment, career advancement, further research and lifelong learning by developing your intellectual, problem solving, technical and other key professional and academic skills.

Core modules:

- > Geographical Information Fundamentals 2.
- > Spatial Information Analysis and Modelling 3.
- > Contemporary Issues in GIS4.
- > Digital Mapping 5.
- > Research Methods and Data Analysis 6.
- > Research Methods.
- > Dissertation.

Applied GIS option modules (choose three):

- > Land Information Systems 7.
- > Remote Sensing of the Environment 8.
- > GIS and Hazards 9.
- > Mobile GIS 10.
- > Mineral and Energy Resources 11.
- > Water Resource Management 12.
- > Waste Management and Contaminated Land Remediation 13.

GIS and Science option modules (choose two):

- > Remote Sensing.
- > GeoVisualisation 14.
- > Geodemographic Analysis.
- > Spatial Databases.
- > Mobile GIS 10.
- > GIS and Health 15.

> Crime Patterns and Environment.

Sweden:

University of Gävle:

Bachelor's degree:

The bachelor's degree is attained after the student has completed the course requirements of 180 credits with particular focus decided by the individual college, of which at least 90 credits will be for gradual specialisation within the main area of study. To gain the Bachelor's degree the student shall, within the framework of the:

- > Geodesy, photogrammetry.
- > Cartography, geographic information.

Technology (GIT) and mathematics:

- > The use of modern instruments and programme software within the main.

Area of geomatics:

- > Working with and carrying out projects.

As a result of the course the student shall have developed the skill and ability to:

- > Understand the need of society for geographical information.
- > Use modern geographical information technology.
- > Use and evaluate different methods of working.
- > Show an ability to work in the different roles required in project work.
- > Present results both orally and in writing.

On completion of the course the student shall:

- > Show the ability to make judgements of the methods of working within.
- > The area of study.
- > Have knowledge and insight of ethical values and issues within the area of study.

Programme description:

Main area:

Main area Geomatics:

The programme consists of the main area Geomatics which is an internationally accepted comprehensive term for individual academic disciplines concerning geographical information. These comprise: photogrammetry, geodesy, surveying, cartography, GIT and remote sensing. In GIT, GIS (geographical information systems) plays a central role as an effective tool. Courses in these disciplines are sometimes identical with courses in geography and spatial planning.

Thesis:

The programme concludes with a bachelor's thesis. In the thesis the student shall show that they can independently carry out a bigger project where they both show proof of the ability to integrate knowledge from the areas studied and to choose relevant methods for solving complex

problems. Generally it is important that in the thesis knowledge from earlier studies is applied, broadened and deepened. Students shall show through their thesis that those goals for a basic university education as given in the Higher Education Act and the Bachelor's degree education as given in the Higher Education Ordinance and the special goals stated in this course of teaching have been achieved. Upon completion of the course the student should be able to take into account the human scientific and environmental demands when solving problems and developing programmes, and has the prerequisites to work for an environmentally adapted technology. The working methods that practice these abilities are therefore central to the programme.

Year 1:

Credits Level Main area:

- 1 Introduction to Higher Education in Sweden, 15 B Technology.
- 2 Geographical Information Technology, 7,5 B Geomatics.
- 2-3 Mathematics: Linear Algebra and Calculus, 15 B Mathematics.
- 3 Basic Cartography 7,5 B Geomatics.
- 4 Basic Land Surveying 7,5 B Geomatics.
- 4 Programming with Visual Basic.NET, 7,5 B Computer science.

Year 2:

Credits Level Main area:

- 1 Field Training in Land Surveying, B Geomatics.
- 1 Mathematics: Statistics and Algebra, 7,5 B Mathematical, Statistics.
- 1 GIS raster/vector 7,5 B Geomatics.
- 2 Geodetic Theory of Errors 7,5 B Geomatics.
- 2 GIS Application Development, alt. Thematic Cartography, 7,5 B Geomatics.
- 3 Photogrammetry 7,5 B Geomatics.
- 3 Mathematics: Multivariable Calculus, 7,5 B Mathematics.
- 4 Geodetic Instruments 7,5 B Geomatics.
- 4 GIS Databases 7,5 B Geomatics.

Year 3:

Credits Level Main area:

- 1 Environmental Geography 7,5 B Geography.
- 1 Spatial Planning in Land Management, 7,5 B Spatial planning.
- 2 Remote Sensing and GIS, Analysis in Land Management, 7,5 B Geomatics.
- 2 Digital Photogrammetry 7,5 B Geomatics.
- 3 Industrial and Special Measurements, B Geomatics.
- 3 Scientific writing 7,5 B Geomatics.
- 4 Bachelor's Thesis 15 B Geomatics.

Those who qualify to be admitted to the Bachelor of Science programme in Geomatics are those who fulfil the conditions for basic qualification as given in the Higher Education Ordinance as well as the following particular qualifications (or equivalent)  
Degree of Bachelor of Science in Geomatics, 180 credits.

India:

Centre For Continuing Education, CEPT University:

Ahmedabad:

**Diploma in Geomatics:**

The Diploma in Geomatics Programme is of one year duration. It is divided into two semesters. The classes are conducted for six days a week, except Sunday from 6.30 p.m. to 9.00 p.m. This course covers Geospatial Science, Cartography, Physics of Remote Sensing, Principles of Aerial Photography, Fundamentals of GIS, Global Positioning System, Spatial Data Base Management, Programming Language, Research Methodology and Statistics. The hands-on practical knowledge is given equal emphasis to learn Digital Image Interpretation, GIS and GPS applied to real time problem solving through case studies and assignments.

**Advance Diploma in Geomatics:**

The duration of Advance Diploma is of two years, comprising of four semesters. The curriculum of first two semesters remains similar to that of the course on 'Diploma in Geomatics'. This course covers Advance Remote Sensing, Digital Photogrammetry, Advance GIS, Applications of GPS, Relational Data Base Management System, Advance Programming Language, Web GIS and Internet Mapping, Location Based System and Navigation. The hands-on practical knowledge is given equal emphasis to give applied knowledge of real time problem solving through case studies, assignments and a project.

**Masters in Geomatics:**

The three year Degree course of Masters in Geomatics primarily aims at creating expertise in the field of Geographic Information System and Remote Sensing. The six semester course provides a complete technological knowledge of the subject leading to design and execution of projects based on Remote Sensing, GIS and GPS. Keeping pace with the advancement in the technology the candidates are prepared to face challenges and adopt futuristic approach to cope up with the requirement and arrive at complete solutions for effective planning and management. This course covers High Level of Remote Sensing, GIS and GPS, Modeling, Software Development and Technical Applications and Dissertation. Periodical group discussions, presentations, preparation of project proposals, their execution, report writing is compulsory.

China:

**University Of Hong Kong:**

Master of Geographic Information Systems (MGIS) degree programme on a two-year part-time and a 16-month full-time basis. Alternatively, a Postgraduate Diploma in Geographic Information Systems (PDipGIS) is available for one-year part-time study.

**Programme Requirements:**

Applicants will normally be required to hold a good honours degree or a relevant professional qualification of equivalent standard with appropriate experience. Three programme options are available to suit individual needs - (1) MGIS two-year part-time, (2) MGIS 16-month full-time and, (3) PDipGIS one-year part-time. Pending satisfactory academic performance, PDipGIS candidates may declare their intention to transfer to the second year of the two-year part-time:

- > GIS Data Processing.
- > Programming for GIS.
- > Photogrammetry and Remote Sensing.
- > Digital Terrain Modelling.



> Cartographic Presentation and Visualisation Programmes.

At the end of completing the PDipGIS programme, students should be able to:

- > Understand the generic concepts in GIS.
- > Develop ability to handle spatial data.
- > Identify data needs, sources, and acquisition procedures.
- > Undertake spatial and cartographic analyses.
- > Operate at least one commercially available GIS.
- > Compile GIS algorithms using a high level language.

In addition to the above skills, students of the MGIS programme should have acquired the knowledge to:

- > Manage GIS projects.
- > Customise applications development at local project, enterprise (Intranet) and distributed (Internet) levels.
- > Resolve standards for data interchange and geospatial processing models.

Additional Pedagogic Requirements for MGIS Programme:

In addition to the courses, students will be required to attend a series of seminars to be offered by scholars and practitioners in the field. Field trips are designed to provide opportunities for students to examine first hand geographic information systems applications in Hong Kong. Candidates of the MGIS programme must also complete a dissertation (see below):

GEOG 7230 MGIS Dissertation:

The course includes two parts: (i) a topic study or research project, and (ii) oral presentation. A topical study or research project must be completed in the form of a dissertation of 10,000 - 20,000 words, with a focus on GIS in an applied setting (such as planning, environmental protection and management, transport, housing, civil engineering, or architecture). The choice of topics may vary from year to year in response to demand and student composition. Each candidate is also required to present their research project proposal in the "Dissertation Seminars".

Coursework:

Candidates must satisfy the examiners in coursework assessment for each of the courses (excluding the dissertation). The assessment of coursework will include oral presentation, written assignments, tests, laboratory and practical work.

Examinations:

Examinations will be held at the end of each semester. Some courses are assessed by 100% coursework:

- > Environmental Mapping.
- > Risk Assessment.
- > Internet GIS.
- > GIS in Transport Planning and Management.
- > GIS Project Management.
- > GIS in Workshop or Internship.
- > GIS in Health Studies.
- > Survey and Data Analysis in Transport Studies.
- > Transport Logistics Planning and Services Management.
- > Seminars, fieldtrips.



- > MGIS Dissertation.
- > [for MGIS students only].
- > Topics in Database Systems.
- > Spatial and Geostatistical Data Analyses.

Comparisons with similar programs that is available has shown that the South African range of qualifications is much more comprehensive. It is concluded from the above that South Africa compares favourably with countries such as Australia, Canada, India, USA, UK and the Sweden, which are considered to have best practise in GIS Science and Technology research.

### **ARTICULATION OPTIONS**

Vertical Articulation is possible with the following qualifications:

- > Bachelor of Geographical Information Science, NQF Level 6.
- > Bachelor of Geographical Information Science (Honours), NQF Level 7.
- > Master of Arts: Geographical Information Science, Level 8.
- > Doctor of Philosophy: GIS, Level 8+.

Horizontal Articulation is possible with the following qualifications:

- > National Diploma: Hydrographic Surveying, NQF Level 5.
- > National Diploma: Surveying NQF Level 5.

### **MODERATION OPTIONS**

> Anyone assessing a learner or moderating the assessment of a learner against this Qualification must be registered as an assessor with the relevant ETQA.

> Any institution offering learning that will enable the achievement of this Qualification must be accredited as a provider with the relevant ETQA.

> Assessment and moderation of assessment will be overseen by the relevant ETQA according to the ETQAs policies and guidelines for assessment and moderation; in terms of agreements reached around assessment and moderation between ETQAs (including professional bodies); and in terms of the moderation guideline detailed immediately below.

> Moderation must include both internal and external moderation of assessments at exit points of the qualification, unless ETQA policies specify otherwise. Moderation should also encompass achievement of the competence described both in individual unit standards as well as the integrated competence described in the qualification.

> Anyone wishing to become an assessor or provider of learning must provide an affordable assessment/learning service.

### **CRITERIA FOR THE REGISTRATION OF ASSESSORS**

For an applicant to register as an assessor, the applicant needs:

- > A minimum of 2 (two) years' relevant occupational experience at NQF Level 6.
- > Declared competent in all the outcomes of the National Assessor Unit Standards as stipulated by SAQA.
- > Detailed documentary proof of educational qualification, practical training undergone, experience gained by the applicant must be provided (Portfolio of evidence).

### **NOTES**

N/A

### **UNIT STANDARDS**

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Fundamental	120476	Adhere to professional conduct and organisational ethics	Level 5	4
Fundamental	242714	Apply elementary statistical methods	Level 5	5
Fundamental	119335	Conduct and apply statistical analyses required to make informed public sector finance decisions	Level 5	15
Fundamental	243840	Use and apply matrices and graphs to solve systems of equations and network problems	Level 5	2
Fundamental	12432	Use mathematical and statistical techniques effectively	Level 5	20
Core	116819	Apply basic Geographic Information System (GIS) vector software functions	Level 4	2
Core	116829	Demonstrate knowledge of capturing methods for primary spatial data	Level 4	8
Core	15234	Apply efficient time management to the work of a department/division/section	Level 5	4
Core	244501	Apply image analysis methodology	Level 5	12
Core	244539	Apply image analysis techniques	Level 5	8
Core	114049	Demonstrate an understanding of Computer Database Management Systems	Level 5	7
Core	258648	Demonstrate fundamental knowledge and understanding of photogrammetry	Level 5	3
Core	15229	Implement codes of conduct in the team, department or division	Level 5	3
Core	116832	Manage a work process	Level 5	3
Core	252025	Monitor, assess and manage risk	Level 5	8
Core	258636	Read hard copy maps	Level 5	3
Core	14277	Select a map projection for cartographic design and production	Level 5	4
Core	258638	Assess fitness for use of spatial data	Level 6	13
Core	258660	Complete an original GIS project under supervision	Level 6	8
Core	258661	Demonstrate a basic knowledge and understanding of photogrammetry	Level 6	8
Core	258654	Demonstrate an understanding of different visual variables used on maps	Level 6	4
Core	258656	Demonstrate an understanding of map composition elements in map production	Level 6	4
Core	258652	Demonstrate an understanding of map design and layout	Level 6	3
Core	258657	Demonstrate an understanding of the context of GI Science	Level 6	4
Core	258650	Demonstrate capability of visual image interpretation of the real world	Level 6	4
Core	258646	Demonstrate understanding of the various spatial and attribute data transfer formats	Level 6	7
Core	258641	Develop a basic understanding of GIS data structures for data acquisition	Level 6	6
Core	11822	Produce cartographic products according to cartographic specifications and design standards	Level 6	6
Core	11820	Select a map projection and transform data between projections or ellipsoids	Level 6	3
Core	258639	Supervise the capture of Geo-information from secondary data sources	Level 6	4
Core	258640	Understand data quality and metadata	Level 6	10
Core	258653	Understand the basic principles of Remote Sensing Imagery	Level 6	4
Core	258658	Work with map projections	Level 6	6
Elective	14910	Apply the principles of Computer Programming	Level 4	8
Elective	14909	Describe the difference between programming in Object Orientated and Procedural Languages	Level 4	4
Elective	252446	Acquire copyright permissions	Level 5	10
Elective	244519	Administer the image acquisition process	Level 5	10
Elective	244516	Analyse an image acquired by an active sensor	Level 5	12
Elective	244509	Analyse the effects of damage on imagery	Level 5	5
Elective	114183	Apply the principles of resolving problems for single-user and multi-user computer operating systems	Level 5	7
Elective	115753	Conduct outcomes-based assessment	Level 5	15
Elective	114048	Create database access for a computer application using structured query language	Level 5	9

	ID	UNIT STANDARD TITLE	LEVEL	CREDITS
Elective	114055	Demonstrate an awareness of ethics and professionalism for the computer industry in South Africa	Level 5	3
Elective	10043	Develop, implement and manage a project/activity plan	Level 5	5
Elective	258643	Process and or create simple cartographic models under supervision	Level 5	12
Elective	119176	Respond to a request for proposal	Level 5	5
Elective	258647	Be aware of the principles of spatial data in database	Level 6	8
Elective	258659	Demonstrate an understanding of the basic principles of spatial data	Level 6	6
Elective	258649	Demonstrate an understanding of topology for storing spatial data	Level 6	4
Elective	258637	Demonstrate basic GPS knowledge	Level 6	4
Elective	258655	Demonstrate knowledge of sources for spatial data	Level 6	4
Elective	258642	Develop simple SQL queries	Level 6	4
Elective	11830	Interpret the Professional and Technical Surveyors' Act, no. 40 of 1984 and the rules framed thereunder	Level 6	3
Elective	258644	Perform basic spatial and hybrid queries under supervision	Level 6	11
Elective	258645	Understand concepts and theory of networks	Level 6	10
Elective	258651	Understand concepts and theory of sampling strategies	Level 6	2
Elective	258635	Use field data capture devices	Level 6	4

#### **LEARNING PROGRAMMES RECORDED AGAINST THIS QUALIFICATION**

**None**



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Use field data capture devices***

<b>SAQA US ID</b>		<b>UNIT STANDARD TITLE</b>	
258635		Use field data capture devices	
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Geographical Information Sciences			
<b>FIELD</b>		<b>SUBFIELD</b>	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	4

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Use a field survey instrument.

**SPECIFIC OUTCOME 2**

Use a laser range finder.

**SPECIFIC OUTCOME 3**

Administer a questionnaire.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Read hard copy maps***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258636	Read hard copy maps		
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Geographical Information Sciences			
<b>FIELD</b>		<b>SUBFIELD</b>	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 5	3

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Understand what maps are.

**SPECIFIC OUTCOME 2**

Understand how to orientate a map.

**SPECIFIC OUTCOME 3**

Relate the map to the real world.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Demonstrate basic GPS knowledge*

SAQA US ID	UNIT STANDARD TITLE		
258637	Demonstrate basic GPS knowledge		
ORIGINATOR	PROVIDER		
SGB Geographical Information Sciences			
FIELD	SUBFIELD		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	4

*This unit standard does not replace any other unit standard and is not replaced by another unit standard.*

**SPECIFIC OUTCOME 1**

Demonstrate an understanding of the GPS satellite system.

**SPECIFIC OUTCOME 2**

Demonstrate an understanding of how a GPS calculates position.

**SPECIFIC OUTCOME 3**

Demonstrate an understanding of errors in GPS positions.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Assess fitness for use of spatial data***

SAQA US ID		UNIT STANDARD TITLE	
258638		Assess fitness for use of spatial data	
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	13

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Understand the parameters given for doing the assessment.

**SPECIFIC OUTCOME 2**

Demonstrate meticulousness, conscientiousness and thoroughness.

**SPECIFIC OUTCOME 3**

Demonstrate an ability to check data manually, semi-automatically and fully automatically.

**SPECIFIC OUTCOME 4**

Log, report on the results, and determine whether or not the data are fit to use.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63589	National Diploma: Geographical Information Science	Level 5





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Supervise the capture of Geo-information from secondary data sources***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258639	Supervise the capture of Geo-information from secondary data sources		
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Geographical Information Sciences			
<b>FIELD</b>		<b>SUBFIELD</b>	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	4

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Define parameters that can be used in the capture of geo-information data from secondary sources.

**SPECIFIC OUTCOME 2**

Supervise a data capture project.

**SPECIFIC OUTCOME 3**

Data capture is verified according to organisational rules and principles.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Understand data quality and metadata***

<b>SAQA US ID</b>		<b>UNIT STANDARD TITLE</b>	
258640		Understand data quality and metadata	
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Geographical Information Sciences			
<b>FIELD</b>		<b>SUBFIELD</b>	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	10

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Understand the principles of data quality.

**SPECIFIC OUTCOME 2**

Understand and interpret metadata.

**SPECIFIC OUTCOME 3**

Compile metadata for a data set.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Develop a basic understanding of GIS data structures for data acquisition***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258641	Develop a basic understanding of GIS data structures for data acquisition		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Geographical Information Sciences			
<b>FIELD</b>	<b>SUBFIELD</b>		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	6

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Use a prescribed spatial reference framework to set up a data capture environment.

**SPECIFIC OUTCOME 2**

Use the appropriate feature type when capturing data.

**SPECIFIC OUTCOME 3**

Understand theory and principles of spatial data models used in data capture.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Develop simple SQL queries***

SAQA US ID	UNIT STANDARD TITLE		
258642	Develop simple SQL queries		
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	4

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Create and execute a simple SQL query under supervision.

**SPECIFIC OUTCOME 2**

Create and execute combinations of simple alphanumeric queries under supervision.

**SPECIFIC OUTCOME 3**

Multiple alphanumeric selection queries are created, executed and stored under supervision.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Process and or create simple cartographic models under supervision***

SAQA US ID	UNIT STANDARD TITLE		
258643	Process and or create simple cartographic models under supervision		
ORIGINATOR	PROVIDER		
SGB Geographical Information Sciences			
FIELD	SUBFIELD		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 5	12

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Understand the concept of cartographic modeling.

**SPECIFIC OUTCOME 2**

Interpret and execute an existing, simple cartographic model.

**SPECIFIC OUTCOME 3**

Understand and explain the stages in the development of a cartographic model.

**SPECIFIC OUTCOME 4**

Adopt a standard method for presenting a cartographic model.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Perform basic spatial and hybrid queries under supervision***

SAQA US ID	UNIT STANDARD TITLE		
258644	Perform basic spatial and hybrid queries under supervision		
ORIGINATOR	PROVIDER		
SGB Geographical Information Sciences			
FIELD	SUBFIELD		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	11

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Create and execute a simple vector spatial query under supervision.

**SPECIFIC OUTCOME 2**

Create and execute a simple raster spatial query under supervision.

**SPECIFIC OUTCOME 3**

Create and execute a combination of simple spatial queries under supervision.

**SPECIFIC OUTCOME 4**

Create and execute hybrid queries under supervision.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Understand concepts and theory of networks***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258645	Understand concepts and theory of networks		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Geographical Information Sciences			
<b>FIELD</b>	<b>SUBFIELD</b>		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	10

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Describe the different types of networks.

**SPECIFIC OUTCOME 2**

Demonstrate a basic understanding of network data structures.

**SPECIFIC OUTCOME 3**

Demonstrate an understanding of the techniques used for network analysis.

**SPECIFIC OUTCOME 4**

Demonstrate an ability to set up and use an existing network model.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	63589	National Diploma: Geographical Information Science	Level 5





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:**

***Demonstrate understanding of the various spatial and attribute data transfer formats***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258646	Demonstrate understanding of the various spatial and attribute data transfer formats		
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Geographical Information Sciences			
<b>FIELD</b>		<b>SUBFIELD</b>	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	7

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Understand vector data transfer formats.

**SPECIFIC OUTCOME 2**

Understand raster data transfer formats.

**SPECIFIC OUTCOME 3**

Understand attribute data transfer formats.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:***Be aware of the principles of spatial data in database*

SAQA US ID		UNIT STANDARD TITLE	
258647		Be aware of the principles of spatial data in database	
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	8

*This unit standard does not replace any other unit standard and is not replaced by another unit standard.*

**SPECIFIC OUTCOME 1**

Demonstrate an understanding of unique identifiers.

**SPECIFIC OUTCOME 2**

Demonstrate an understanding of label properties.

**SPECIFIC OUTCOME 3**

Demonstrate an understanding of Spatial Data Types and the representation thereof.

**SPECIFIC OUTCOME 4**

Demonstrate an understanding of Spatial Data Indexes.

**SPECIFIC OUTCOME 5**

Demonstrate an understanding of location and spatial reference identification.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Demonstrate fundamental knowledge and understanding of photogrammetry***

SAQA US ID	UNIT STANDARD TITLE		
258648	Demonstrate fundamental knowledge and understanding of photogrammetry		
ORIGINATOR	PROVIDER		
SGB Geographical Information Sciences			
FIELD	SUBFIELD		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 5	3

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Demonstrate an understanding of photographic scale.

**SPECIFIC OUTCOME 2**

Demonstrate knowledge of flight planning for aerial photography.

**SPECIFIC OUTCOME 3**

Demonstrate understanding of qualitative and quantitative information extraction.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Demonstrate an understanding of topology for storing spatial data***

SAQA US ID	UNIT STANDARD TITLE		
258649	Demonstrate an understanding of topology for storing spatial data		
ORIGINATOR	PROVIDER		
SGB Geographical Information Sciences			
FIELD	SUBFIELD		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	4

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Demonstrate an understanding of components of the topology model.

**SPECIFIC OUTCOME 2**

Explain different topological characteristics.

**SPECIFIC OUTCOME 3**

Demonstrate an understanding of the advantages of storing topology for spatial data.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Demonstrate capability of visual image interpretation of the real world***

SAQA US ID	UNIT STANDARD TITLE		
258650	Demonstrate capability of visual image interpretation of the real world		
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD	SUBFIELD		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	4

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Understand the characteristics of remotely sensed images.

**SPECIFIC OUTCOME 2**

Identify different features visually.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Understand concepts and theory of sampling strategies***

SAQA US ID		UNIT STANDARD TITLE	
258651		Understand concepts and theory of sampling strategies	
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	2

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Understand probability methods of sampling.

**SPECIFIC OUTCOME 2**

Understand non-probability methods of sampling.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Demonstrate an understanding of map design and layout***

SAQA US ID		UNIT STANDARD TITLE	
258652		Demonstrate an understanding of map design and layout	
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	3

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Demonstrate the use of the graphic elements of map design.

**SPECIFIC OUTCOME 2**

Plan a maps design.

**SPECIFIC OUTCOME 3**

Demonstrate an understanding of map generalisation.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63689	National Diploma: Geographical Information Science	Level 5





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Understand the basic principles of Remote Sensing Imagery***

SAQA US ID	UNIT STANDARD TITLE		
258653	Understand the basic principles of Remote Sensing Imagery		
ORIGINATOR	PROVIDER		
SGB Geographical Information Sciences			
FIELD	SUBFIELD		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	4

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Understand the importance of sensor design in remote sensing.

**SPECIFIC OUTCOME 2**

Understand how satellites work.

**SPECIFIC OUTCOME 3**

Define remote sensing and the components of a remote sensing system.

**SPECIFIC OUTCOME 4**

Describe the role played by the electromagnetic spectrum in remote sensing.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

## UNIT STANDARD:

*Demonstrate an understanding of different visual variables used on maps*

SAQA US ID	UNIT STANDARD TITLE		
258654	Demonstrate an understanding of different visual variables used on maps		
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	4

*This unit standard does not replace any other unit standard and is not replaced by another unit standard.*

**SPECIFIC OUTCOME 1**

Demonstrate the use of different visual variables with point data.

**SPECIFIC OUTCOME 2**

Demonstrate the use of different visual variables with line data.

**SPECIFIC OUTCOME 3**

Demonstrate the use of different visual variables with polygon data.

**SPECIFIC OUTCOME 4**

Demonstrate the use of different charts.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Demonstrate knowledge of sources for spatial data***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258655	Demonstrate knowledge of sources for spatial data		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Geographical Information Sciences			
<b>FIELD</b>	<b>SUBFIELD</b>		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	4

***This unit standard replaces:***

<b>US ID</b>	<b>Unit Standard Title</b>	<b>NQF Level</b>	<b>Credits</b>	<b>Replacement Status</b>
116824	Demonstrate knowledge of sources for spatial data	Level 4	1	Will occur as soon as 258655 is registered

**SPECIFIC OUTCOME 1**

Identify the different sources for the core data sets as defined by South Africa's Committee for Spatial Information (CSI).

**SPECIFIC OUTCOME 2**

Identify the different sources for other vector data sets.

**SPECIFIC OUTCOME 3**

Identify the different sources for other raster data sets.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:***Demonstrate an understanding of map composition elements in map production*

SAQA US ID		UNIT STANDARD TITLE	
258656		Demonstrate an understanding of map composition elements in map production	
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	4

*This unit standard does not replace any other unit standard and is not replaced by another unit standard.*

**SPECIFIC OUTCOME 1**

Include fundamental elements on a new map.

**SPECIFIC OUTCOME 2**

Select a spatial contextual reference to include on the map.

**SPECIFIC OUTCOME 3**

Select a map grid to include on the map.

**SPECIFIC OUTCOME 4**

Include technical references for map data where appropriate.

**SPECIFIC OUTCOME 5**

Include symbology reference on the map.

**SPECIFIC OUTCOME 6**

Include legal references on the map, as appropriate.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63689	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Demonstrate an understanding of the context of GI Science***

SAQA US ID		UNIT STANDARD TITLE	
258657		Demonstrate an understanding of the context of GI Science	
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	4

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Demonstrate a generic understanding of what GIS is.

**SPECIFIC OUTCOME 2**

Demonstrate an appreciation of the specialist knowledge needed to build a proper GI system.

**SPECIFIC OUTCOME 3**

Demonstrate an understanding of how GIS can be used in different industries.

**SPECIFIC OUTCOME 4**

Demonstrate an understanding of the functionality available from a GIS.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Work with map projections***

SAQA US ID		UNIT STANDARD TITLE	
258658		Work with map projections	
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	6

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Explain components of a reference system.

**SPECIFIC OUTCOME 2**

Identify appropriate Map Projection for a specific task.

**SPECIFIC OUTCOME 3**

Convert from one projection and or reference system to another.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Demonstrate an understanding of the basic principles of spatial data***

<b>SAQA US ID</b>	<b>UNIT STANDARD TITLE</b>		
258659	Demonstrate an understanding of the basic principles of spatial data		
<b>ORIGINATOR</b>	<b>PROVIDER</b>		
SGB Geographical Information Sciences			
<b>FIELD</b>	<b>SUBFIELD</b>		
12 - Physical Planning and Construction	Physical Planning, Design and Management		
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	6

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Demonstrate an understanding of models of the real world.

**SPECIFIC OUTCOME 2**

Demonstrate a basic understanding of the vector data model.

**SPECIFIC OUTCOME 3**

Demonstrate a basic understanding of the raster data model.

**SPECIFIC OUTCOME 4**

Understand the concept of attribute extractions from real world entities.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Elective	63589	National Diploma: Geographical Information Science	Level 5





## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:*****Complete an original GIS project under supervision***

<b>SAQA US ID</b>		<b>UNIT STANDARD TITLE</b>	
258660		Complete an original GIS project under supervision	
<b>ORIGINATOR</b>		<b>PROVIDER</b>	
SGB Geographical Information Sciences			
<b>FIELD</b>		<b>SUBFIELD</b>	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
<b>ABET BAND</b>	<b>UNIT STANDARD TYPE</b>	<b>NQF LEVEL</b>	<b>CREDITS</b>
Undefined	Regular	Level 6	8

***This unit standard does not replace any other unit standard and is not replaced by another unit standard.***

**SPECIFIC OUTCOME 1**

Interpret a project scope.

**SPECIFIC OUTCOME 2**

Prepare a GI System to solve the problem.

**SPECIFIC OUTCOME 3**

Develop the project.

**SPECIFIC OUTCOME 4**

Develop spatial operations required for the project.

**SPECIFIC OUTCOME 5**

Develop map reports.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	<b>ID</b>	<b>QUALIFICATION TITLE</b>	<b>LEVEL</b>
Core	63589	National Diploma: Geographical Information Science	Level 5



## SOUTH AFRICAN QUALIFICATIONS AUTHORITY

**UNIT STANDARD:***Demonstrate a basic knowledge and understanding of photogrammetry*

SAQA US ID		UNIT STANDARD TITLE	
258661		Demonstrate a basic knowledge and understanding of photogrammetry	
ORIGINATOR		PROVIDER	
SGB Geographical Information Sciences			
FIELD		SUBFIELD	
12 - Physical Planning and Construction		Physical Planning, Design and Management	
ABET BAND	UNIT STANDARD TYPE	NQF LEVEL	CREDITS
Undefined	Regular	Level 6	8

*This unit standard does not replace any other unit standard and is not replaced by another unit standard.*

**SPECIFIC OUTCOME 1**

Demonstrate a basic understanding of aerial photography.

**SPECIFIC OUTCOME 2**

Demonstrate a basic knowledge and understanding of Ground Control.

**SPECIFIC OUTCOME 3**

Demonstrate an understanding of the science of photogrammetry.

**QUALIFICATIONS UTILISING THIS UNIT STANDARD**

	ID	QUALIFICATION TITLE	LEVEL
Core	63589	National Diploma: Geographical Information Science	Level 5