AUTOCAD / SOLIDWORKS

PURPOSE AND RATIONALE OF THE QUALIFICATION

Purpose:

Any learners, who are, or wish to be involved in the Computer Aided Drawing, will have access to this qualification. This qualification is intended to serve the architectural, engineering and construction industries by providing skilled draughtspersons who can produce design drawings which address the need to move from traditional manual drafting to Computer Aided Drawing and Draughting. Portability across other National Qualifications in Engineering and Draughting is therefore ensured.

The qualifying learner will be capable of:

 Understanding the Computer Aided Drawing office environment.
 Using Computer Aided Drawing office equipment and instruments.
 Producing Computer Aided drawings.

Rationale:

Computer Aided Design supports the Design Engineering activity that includes creation of 2D/3D Geometric models doing engineering analysis, evaluating the design by simulation and produce rapid drafting for manufacturing with the help of computers. The traditional CAD System offers 2D drafting, 3D modelling with limited modification capability. This system substitutes the drafting board completely. The high end 3D CAD tool provides many solutions under one platform. If alteration is made in one feature then it will automatically change other related (dependent) features. Dimensional and geometrical constrains play a major role in this parametric design technology. Testing the designs on the computer instead of expensive and time-consuming field tests leads to significant reduction in product development cycles. Cost and time to market is another advantage. The modern CAD System helps product design under practical constraints helps enormously imaginative concepts.

The FETC in Computer Aided Drawing (CAD) Office Practice is an entry level qualification for the workplace designed in consultation with industry experts. Qualifying learners will gain a broad base of knowledge and skills needed for entry into the industry that will also provide the basis for further learning along this career pathway, including learners who:

 Were previously disadvantaged or who were unable to complete their schooling and were therefore denied access to Further Education and Training.
 Have worked in Computer Aided Drawing for many years, but have no formal qualification in Computer Aided Drawing.
 Wish to extend their range of skills and knowledge of the industry so that they can become knowledgeable workers in Computer Aided Drawing and Draughting.

The FETC in Computer Aided Drawing Office Practice allows the learner to work towards a nationally recognised qualification. The qualification will allow both those in formal education and those already employed in, but not limited to, architectural, engineering and construction organisations access, due to its flexibility. It aims to develop learners who are informed and skilled in Computer Aided Drawing and Draughting.

The FETC in Computer Aided Drawing Office Practice will produce knowledgeable, skilled Computer Aided Draughtspersons who are able to contribute to improved productivity and efficiency within the draughting industry. It will provide the means for current learners in the Computer Aided Drawing field to receive recognition for prior learning and to upgrade their skills and knowledge base. The qualification is structured for learners to acquire a set of core competencies to give a broad understanding of Computer Aided Drawing. The electives will allow for specific competence in a selected area of drawing specialization such as:

- Mining Engineering.
- Mechanical Engineering.
- Surveying.
- Naval Architecture (Ship/boat design).
- Electrical Engineering.
- Interior/spatial design.
- Landscaping.
- Automotive Engineering.
- Structural steel detailing.
- Reinforced Concrete Detailing.
- Piping and plant design.
- Construction.
- Civil/structural Engineering.
- Instrumentation Engineering.
- Engineering and design draughting.
- Air-conditioning and ventilation design.
- Architecture.
- Furniture design.
- Town and regional planning.
- Graphic design.
- Industrial design.
- Aeronautics.

LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING

It is assumed that learners are already competent in the following:

- Communication at NQF Level 3.
- Mathematical literacy at NQF Level 3.

Recognition of Prior Learning:

The structure of this Unit Standard based Qualification makes the

Recognition of Prior Learning possible, if the learner is able to demonstrate competence at the level of unit standards and exit level outcomes as described.

Access to the Qualification:

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

RECOGNISE PREVIOUS LEARNING?

Y

QUALIFICATION RULES

The Qualification consists of a Fundamental, a Core and an Elective Component.

 All Fundamental Unit Standards, totalling 56 Credits are compulsory.
 All Core Unit Standards, totalling 53 credits are compulsory.
 The Elective Component consists of clusters of Unit Standards related to 5 areas of specialization. Learners are to choose all Unit Standards related to at least one specialization stream as clustered below (Minimum of 22 credits).

Mechanical drawings (31 credits):

 ID 263014: Demonstrate an understanding of production, manufacturing and construction processes as it affects the drawing, NQF Level 5, 3 credits.
 ID 263013: Demonstrate an understanding of engineering materials and processes, NQF Level 5, 6 credits.
 ID 263012: Demonstrate an understanding of various mechanical components, NQF Level 5, 10 credits.
 ID 262944: Interpret, read and produce mechanical drawings, NQF Level 4, 12 credits.

Electrical, Air conditioning, Vent duct and plant drawings (29 credits):

 ID 263014: Demonstrate an understanding of production, manufacturing and construction processes as it affects the drawing, NQF Level 5, 3 credits.
 ID 263013: Demonstrate an understanding of engineering materials, heat treatment and machinery, NQF Level 5, 6 credits.
 ID 263012: Demonstrate an understanding of various mechanical components, NQF Level 5, 6 credits.
 ID 263006: Interpret, read and produce electrical drawings, NQF Level 4, 8 credits.
 ID 120201: Identify, interpret and produce working air conditioning and ventilation duct and plant drawings, NQF Level 4, 6 credits.

Architectural and civil construction draughting (22 credits):

 ID 11637: Set up a survey instrument to take observations, level 3, 4 credits.

 ID 262985: Interpret, read and produce architectural draughting drawings, NQF Level 4, 18 credits.

Concrete reinforcing and structural steel drawings (30 credits):

 ID 262965: Interpret, read and produce structural steel drawings for workshop fabrication, NQF Level 4, 12 credits.
 ID 120198: Interpret, read and produce reinforced concrete detail drawings, NQF Level 4, 12 credits.
  ID 243086: Draw and interpret complex plate, pipe and structural steel plate, pipe and structural steel drawings, NQF Level 3, 6 credits.

Piping drawings (37 credits):

 ID 253592: Identify, interpret and produce working piping drawings, NQF Level 4, 6 credits.
 ID 254076: Demonstrate knowledge of hydraulics and flow measurement in water and wastewater systems, NQF Level 3, 12 credits.
 ID 263012: Demonstrate an understanding of various mechanical components, NQF Level 5, 10 credits.
 ID 253588: Perform piping offset calculations, NQF Level 3, 5 credits.
 ID 244093: Read and interpret process and instrumentation diagrams, NQF Level 3, 4 credits.

EXIT LEVEL OUTCOMES

1. Operate a computer to produce 2D and 3D working drawings.

2. Apply drawing office practice.

3. Plan and monitor drawing office workflow process.

4. Produce freehand drawings.

ASSOCIATED ASSESSMENT CRITERIA

Associated Assessment Criteria for Exit Outcome Level 1:

1.1 Client requirements are interpreted and Computer Aided Drawing software is activated and customized according to software commands and applications.
1.2 A detailed 2D Computer Aided Drawing is produced according to client's confirmed requirements, software functions and drawing office procedures within agreed time frame.
1.3 A 3D Computer Aided Drawing is produced according to client's verified requirements, software functions and drawing office procedures within agreed time frame.
1.4 Administrative and office procedures are conducted in terms of produced drawings according to organisational requirements.

Associated Assessment Criteria for Exit Outcome Level 2:

2.1 Historical development of drawings is described in relation to major influences and trends that impact on current drawing office practice.
2.2 Drawing office organogram and layout is described and the use of equipment is explained in terms of their function and safety requirements.
2.3 Drawing office administration and cost implications of reproductions and revisions are explained in relation to drawing office procedures.
2.4 Occupational, health, safety and housekeeping requirements are applied in terms of drawing office practice.

Associated Assessment Criteria for Exit Outcome Level 3:

3.1 A computer system is set up, customized, used and maintained in relation to the software and hardware applications, manufacturer's instructions and drawing office procedures.
3.2 The nature and scope of planning and scheduling of work processes are explained in relation to a drawing office.
3.3 Workflow process is planned and scheduled in terms of the sourced data, work activities, resources and facilities in required format within given time frame.
3.4 The achievement of the workflow plan is monitored and adjusted as necessary in accordance with requirements and within agreed time frames.

Associated Assessment Criteria for Exit Outcome Level 4:

4.1 Drawing office measuring instruments are used and maintained according to manufacturer's instructions.
4.2 Client brief is interpreted and technical data is recorded according to organizational procedures.
4.3 On-site information and data is applied to the design in conformation to standards and code of practice for engineering.
4.4 A free hand drawing and 3D model is produced for client approval of design according to drawing office procedures.

Integrated Assessment:

The importance of integrated assessment is to confirm that the learner is able to demonstrate applied competence (practical, foundational and reflexive) and ensure that the purpose of this Qualification is achieved. Both formative and summative assessment methods and strategies are used to ensure that the Exit Level Outcomes and the purpose of the Qualification are achieved through achieving the Unit Standards. Learning, teaching and assessment are inextricably linked.

Learning and assessment should be integrated and assessment practices must be fair, transparent, valid and reliable. A variety of assessment strategies and approaches must be used. This could include tests, assignments, projects, demonstrations and/or any applicable method. Evidence of the acquisition of competencies must be demonstrated through the Unit Standards, which enhance the integration of theory and practice as deemed appropriate at this level.

Formative assessment is an on-going process which is used to assess the efficacy of the teaching and learning process. It is used to plan appropriate learning experiences to meet the learner's needs. Formative assessments can include a mix of simulated and actual (real) practice or authentic settings. Feedback from assessment informs both teaching and learning. If the learner has met the assessment criteria of all the Unit Standards then s/he will have achieved the Exit Level Outcomes of the Qualification.

Summative assessment is concerned with the judgement of the learning in relation to the Exit Level Outcomes of the Qualification. Such judgement must include integrated assessment(s) which test the learner's ability to integrate the larger body of knowledge, skills and attitudes, which are represented by the Exit Level Outcomes. Summative assessment can take the form of oral, written and practical examinations as agreed to by the relevant ETQA.

Integrated assessment must be designed to achieve the following:

 An integration of the achievement of the Exit Level Outcomes in a way that reflects a comprehensive approach to learning and shows that the purpose of the Qualification has been achieved.
 Judgement of learner performance to provide evidence of applied competence or capability.

Assessors and moderators should make use of a range of formative and summative assessment methods. Assessors should assess and give credit for the evidence of learning that has already been acquired through formal, informal and non-formal learning and work experience.

Assessment should ensure that all specific outcomes, embedded knowledge and critical cross-field outcomes are assessed. The assessment of the critical cross-field outcomes should be integrated with the assessment of specific outcomes and embedded knowledge.

INTERNATIONAL COMPARABILITY

The most common type of training in Computer Aided Design (CAD) worldwide takes the form of short courses that are offered by CAD software manufacturers and distributors. Each of these CAD software brands offer buyers demonstrations, on-line training, help facilities as well as training that caters only for the operation of the software in terms of its functions.

The focus of this benchmarking exercise is focused on qualifications that offer the qualifying learner a range of competencies that go beyond the operation of particular CAD software to include knowledge and skills that are required to practice in the work environment of a CAD office. Examples of similar structured qualifications were considered from the following countries:

 United Kingdom.

 New Zealand.
 United States of America.

United Kingdom:

The Level 3 NVQ in Design and Draughting (Reference Number 100/3323/3) is similar to the South African Further Education and Training Certificate in CAD Office Practice in terms of the purpose of the qualification and the broad outcomes described in these qualifications. The level of complexity and duration of study is also very similar.

The aim of this qualification is to validate the competence of the site-based workforce of the engineering construction industry against national standards. The qualification focuses on the skills craftsperson's need in their daily working life, giving employer's confidence in the level of competence of their employers. This qualification is currently being used by industry. Candidates must complete all core units and one optional unit.

Core Units:

 A/102/1519: Contribute to effective working relationships.
 M/102/1520: Work safely, minimize risk and comply with emergency procedures.
 H/102/1501: Read and extract information from engineering drawings and specifications.
 K/102/1502: Identify and assess factors that impact on engineering design briefs.
 M/102/1503: Complete chosen engineering designs.
 T/102/1504: Review technical information to produce detailed engineering drawings.
 A/102/1505: Produce detailed drawings to support engineering activities.
 F/102/1506: Minimise risk to life, property and the environment within a design and draughting context.
 J/102/1507: Generate and evaluate engineering design options.

Optional Units:

 J/102/1510: Develop design options.
 L/102/1511: Communicating design options.

New Zealand:

The National Certificate in Design (Draughting) (Level 2) [Ref: 0640] (70 credits) is designed for people who are entering the draughting sector of the design industry. It is a combination of theoretical and practical skills which can be acquired on or off job.

Core unit standards (50 credits):

 ID 7481: Produce design ideas and images using computer graphics programs, Level 2, 3 credits.

 ID 7482: Produce orthographic, scale working drawings using computer aided draughting (CAD) programs, Level 2, 3 credits.
 ID 7483: Produce scale production drawings using computer aided draughting (CAD) programs, Level 3, 5 credits.
 ID 7484: Produce and deliver a multi-media presentation, Level 4, 5 credits.
 ID 7485: Interpret a design brief, and select and present information for solutions, Level 1, 3 credits.
 ID 7488: Present design material, Level 1, 3 credits.
 ID 7492: Present design work, Level 2, 3 credits.
 ID 7496: Prepare, plan, and present design project work, Level 3, 4 credits.
 ID 15730: Produce conceptual design ideas, Level 4, 15 credits.
 ID 15348: Demonstrate knowledge of numerical data used in the draughting industry, Level 2, 6 credits.

Elective unit standards (20 credits):

 Describe and operate a personal computer system.
 Demonstrate knowledge of the application and impact of information technology.
 Protect health and safety in the workplace.
 Communicate information in a specified workplace.
 Participate in groups and/or teams to gather ideas and information.
 Read texts for practical purposes.
 Write a technical report.
 Investigate a chemical process.
 Demonstrate knowledge of atomic structure.
 Demonstrate knowledge of thermodynamics.
 Demonstrate knowledge of reaction rates and mechanisms.
 Demonstrate knowledge of the behaviour of gases.
 Demonstrate knowledge of linear motion.
 Demonstrate knowledge of energy transformations.
 Demonstrate knowledge of atomic structure and fission reactions.
 Demonstrate knowledge of energy, momentum and equilibrium.
 Demonstrate knowledge of the physics of the properties of materials under stress.
 Demonstrate knowledge of heat and temperature.

United States of America:

An example of an equivalent qualification is the Computer Aided Design (CAD) Technology Program (60 Credit Hours) offered by Truman College, Chicago provides the technical instruction and skill development for the student to become successfully employed in the drafting fields of the mechanical, architectural and construction industry. Instruction is directed toward theoretical and technical skills in the use of modern drafting tools and equipment. Emphasis is placed on the training of computer aided design (CAD) technologies.

Besides the 17 credit hours assigned to General Education Requirements or the fundamentals, which includes "Communications"(English 101) and

"General Education" (Math 101); much like the South African qualification, the following core and elective module titles apply:

CAD Technology:

 0130: Technical Illustration.
 0170: Computer-Aided Design I for Mechanical Design Technicians.
 0171: Computer-Aided Design II for Mechanical Design Technicians.
 0172: Computer-Aided Design III for Mechanical Design Technicians.

Computer Information Systems:

 0103: Introduction to Basic Language.
 0116: Introduction to Operating Systems.
 0123: Introduction to Spreadsheets on Microcomputers.

Engineering:

 0100: Elements of Engineering Drawing.
 0110: Introductory Drafting.
 0111: Introduction to the Engineering Profession.
 0131: Engineering Graphics and Introduction to Design.
 0132: Descriptive Geometry.
 0190: Computer Applications in Engineering.
 0202: Advanced Drafting and Basic Machine Design.

Conclusion:

All the qualifications described above reflect both similarities and differences with the South African Further Education and Training Certificate in CAD Office Practice. The glaring difference lies in the approach to the elective component of the qualifications. The South African approach is unique in that is offers a choice of applying CAD Practice in five areas of specialization within the Civil Engineering Construction workplace: Mechanical drawings, Electrical, Air conditioning, Vent duct and plant drawings, Architectural and civil construction draughting, Concrete reinforcing and structural steel drawings and Piping drawings.

The ability to read, interpret and produce 2D and 3D civil engineering drawings lies at the heart of these qualifications. While these qualifications differ in the terms used to categorise learning areas as modules, subjects and units; the nature and extent of the competencies are captured at the level of unit standards, specific outcomes, assessment criteria and embedded knowledge in the South African unit standards.

ARTICULATION OPTIONS

This qualification lends itself to both horizontal and vertical articulation. Examples of horizontal articulation are:

 ID 21149: Certificate: AutoCAD, NQF Level 4.

 ID 49127: Further Education and Training Certificate: Design Foundation, NQF Level 4.

Examples of vertical articulation are:

 ID 24317: Certificate: Project Design, NQF Level 5.
 ID 36015: Higher Diploma: Interior design and CAD, NQF Level 6.

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 Education, Training, Quality, and Assurance (ETQA) Body.

 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 ETQA's policies and guidelines for assessment and moderation; in terms of agreements reached around assessment and moderation between ETQA's (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, the integrated competence described in the Qualification and will include competence within core sales and the elective standards relevant to the economic sector.

Anyone wishing to be assessed against this Qualification may apply to be assessed by any assessment agency, assessor or provider institution that is accredited by the relevant ETQA.