Engineering Council of Namibia

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STANDARDS FOR BACHELOR OF TECHNOLOGY DEGREES IN ENGINEERING

B.Tech. (ENG)

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1. OVERVIEW

This document defines the outcomes expected of a Bachelor of Technology Degree programmes in Engineering and sets the minimum educational and performance standards that are needed for registration with the Engineering Council of Namibia in the category of **Incorporated Engineer in training**. It is expected that curricula developers will use this document as a blueprint to produce engineering curricula that are aligned with professional standards in Namibia, while taking into consideration other requirements that are within their institutional autonomy.

Bachelor of Technology Degrees in Engineering (B.Tech. (Eng)) that are referred to in this document conform to characteristics that define such degrees at **Level 7** of the National Qualifications Framework (NQF) of Namibia. In addition to meeting the minimum credit requirements of the NQF of Namibia, this document specifies a minimum of **480 NQF Credits** for a Bachelor of Technology Degree in Engineering. This has been done to ensure conformity with the requirements of the Sydney Accord, to which the Engineering Council of Namibia wishes to be a signatory.

This document is divided into three chapters. In addition to chapter 1, chapter 2 states the minimum required outcomes of an accredited degree programme in engineering. Chapter 3 defines the minimum learning assumed at entry to these programmes and chapter 4 defines the level of certification and the minimum curriculum content for the various knowledge areas that are expected to be covered in an undergraduate engineering degree programme. Chapter 5 provides indicative requirements for designation of a degree programme in a disciplinary or cross-disciplinary field for purposes of accreditation by the Namibia Qualifications Authority **(NQA)** and the Engineering Council of Namibia. Chapter 6 states the required competencies or exit level outcomes of a graduate engineer. It is envisaged that degree programmes developed using these specifications will be fully accreditable by the National Qualifications Authority (NQA) and the Engineering Council of Namibia. Furthermore, holders of Bachelor of Technology Degrees that meet the requirements as set out in this document may lead to registration with the Engineering Council of Namibia as **Incorporated Engineers (Inc. Eng.).**

2. PURPOSE OF ACCREDITED ENGINEERING PROGRAMMES

Engineering is a profession that serves the needs of society and the economy. Programmes leading to the Bachelor of Technology Degree in engineering are designed to contribute towards meeting this need by developing engineering competence. Therefore, the purpose of engineering programmes accredited as satisfying these standards is to provide:

2.1 Competently apply an integration of theory, principles, proven techniques, practical experience and appropriate skills to the solution of **broadly defined** problems in the field of engineering while operating within the relevant standards and codes.

2.2 Demonstrate well-rounded general engineering knowledge, as well as systematic knowledge, of the main terms, procedures, principles and operations of one of the disciplines of engineering.

2.3 Gather evidence from primary sources and journals using advanced retrieval skills, and organize, synthesize and present the information professionally in a mode appropriate to the audience.

2.4 Apply the knowledge gained to new situations, both concrete and abstract, in the workplace/community.

2.5 Identify, analyse, conduct and manage a project.

2.6 Make independent decisions/judgments taking into account the relevant technical, economic, social and environmental factors.

2.7 Work independently, as a member of a team, and as a team leader.

2.8 Relate engineering activity to health, safety and environment, cultural, and economic sustainability.

2.9 Meet the requirements for registration with the Engineering Council of Namibia as an Incorporated Engineer in Training.

2.10 Demonstrate the capacity to explore and exploit educational, entrepreneurial, and career opportunities, and to develop him/her professionally.

2.11 Proceed to postgraduate studies, both course-based and research based.

3. MINIMUM LEARNING ASSUMED TO BE IN PLACE

Specifications set in this document assume that entrants to programmes that conform to these standards are proficient in:

3.1 For school leavers:

3.1.1 A Namibia Senior School Certificate (NSSC) with Mathematics, Physical Science and English, all passed with at least an A symbol or an equivalent certificate.

3.2 For National Diploma in Engineering holders:

3.2.1 A National Diploma consisting of at least 360 NQF Credits as set out in the document “STANDARDS FOR A NATIONAL DIPLOMA IN ENGINEERING”. A maximum of 360 credits of the diploma may contribute towards the 480 credits for the Bachelor of Technology Degree in Engineering.

It is further understood that providers may choose to offer Pre-, Access, Bridging or Foundation programmes to enable learners who do not possess the minimum learning stated above to improve their basic knowledge in the stated subjects.

4. CERTIFICATION LEVEL AND MINIMUM PROGRAMME CONTENT

Section 4.1 defines the general requirements of a Bachelor of Technology Degree in Engineering and section 4.2 defines an NQF credit. Section 4.3 states the basis for the total programme credits. The minimum programme content by knowledge area is defined in section 4.4.

4.1 Requirements for a Bachelor of Technology Degree in Engineering

A Bachelor of Technology Degree in Engineering must:

(Build to a level of conceptual sophistication, specialized knowledge and intellectual autonomy that is consistent with a Bachelor of Technology Degree Level 7 on the NQF. This degree may build onto a National Diploma in engineering as set out in the document "STANDARDS FOR A NATIONAL DIPLOMA IN ENGINEERING".).

4.1.1 Include an **industry-initiated** terminal project in the form of a design exercise, building project, manufacturing undertaking or other practice-based exercise that is systematically supervised by a senior member of the teaching staff with the intension of demonstrating the graduate's readiness for employment in the professional or occupational field of the qualification.

4.1.2 Require performance in accordance with a regulatory framework administered by a regulatory or professional body, which must act in such a way as to accommodate institutional autonomy.

4.1.3 Be offered at **NQF Level 7** Certification.

4.2 NQF Credit Value

4.2.1 One NQF Credit represents ten (10) hours of Notional Learning Time. Learning time is an estimation of the time it takes an average learner to achieve the performance requirements of a given award.

4.2.2 According to the Namibian NQF, learning time should include all relevant learning activities that contribute to the attainment of the outcomes of learning. Such activities should include:

- (a) Formal, directed learning including classes, training sessions, coaching, seminars and tutorials.
- (b) Practical work in laboratories or other locations.
- (c) Information retrieval, e.g. from libraries or the web.
- (d) Self-directed study, such as private study, revision.
- (e) Work-based activities that lead to a formal assessment.
- (f) Practice aimed at gaining, applying and refining skills.
- (g) Undertaking all forms of assessment (examinations, tests, quizzes etc).
- (h) Counselling, mentoring and personal reflection.

4.2.3 A Notional Hour is therefore made up of a combination of 'Learning Time' (individual private time in the learning process) and 'Delivery Time' or 'Contact Hours' (lecture hours, teaching time in classrooms, training sessions, coaching, seminars, guided tutorials and other lecturer-learner contact).

4.3 Minimum Credit Values Per Programme

4.3.1 A Bachelor of Technology Degree in engineering shall consist of a minimum of **480 NQF Credits** accumulated from Level 4 up to at least Level 7.

4.3.2 The total number of contributing credits must contain a minimum of 120 NQF Credits at least at Level 7.

4.3.3 Preparatory, remedial or bridging courses may be part of a programme; however, they cannot contribute towards the total credits if they are below Level 4. The maximum number of contributing credits from Level 4 is limited to 40 NQF Credits.

4.3.4 Since one Credit equals 10 notional hours, a full programme should comprise of at least 4800 notional hours. In an eight-semester programme, this is equivalent to an average of 600 notional hours (60 Credits) per semester.

4.3.5 In courses which have significant student activity but low contact time such as major designs, the credit value should be calculated by expressing the notional activity for the course as a fraction of the total notional contact for a full-time semester and assigning credits in proportion. For example, a final design course which occupies 50% of the total notional activity within a semester but accounts for only 5% of the actual contact time is allocated 50% of 70 credits = 35 credits.

4.4 Indicative Minimum Programme Content

Table 1 specifies the minimum credits within the programme in the six specified knowledge areas. The minimum values specified are set at levels that will accommodate programmes during the transition to these outcomes-based criteria. These values will be reviewed as experience is gained.

Table 1: Minimum Curriculum Content by Knowledge Area

KNOWLEDGE AREA	MINIMUM CREDITS
Mathematics	40
Basic Sciences	20
Engineering Science and Principles	180
Engineering Design and Synthesis	50
Computing and Information Technology	40
Complementary Studies	40 but not more than 80
SUBTOTAL (minimum)	**370**
Discretionary Studies	110 (maximum)
TOTAL	**480**

5. DESIGNATION OF DEGREE BY DISCIPLINE & USE OF QUALIFIERS

5.1 Currently, the Engineering Council of Namibia will assist the NQA with the accreditation of programmes in the following engineering disciplines: Aeronautical, Agricultural, Chemical, Civil, Electrical, Electronic, Industrial, Marine, Metallurgical, Mechanical and Mining. Cross-disciplinary designations may also be included. These disciplines may be expanded, as the Engineering Council of Namibia may desire.

5.2 Qualifications obtained from accredited programmes must contain the word 'Engineering' as well as a disciplinary or cross-disciplinary qualifier defined in the provider's rules for the degree and reflected on the academic transcript and degree certificate.

5.3 A programme must have a coherent core of mathematics, basic sciences and fundamental engineering sciences that provides a viable platform for further independent study. The platform must enable development in a traditional discipline or in an emerging field.

5.4 Appendix 1 provides the definitions of the Knowledge Areas as set out in Table 1.

5.5 Appendix 2 provides an **indicative** guide to fundamental engineering science content in subject areas for various designated programmes. A programme may contain specialist-engineering study in at least one sub-discipline of the designated discipline at the exit level if and when the stakeholders so desire.

5.6 Appendix 3 sets out the method of how a credit can be calculated.

5.7 Appendix 4 sets out the NQF (Namibian Qualification Framework) level descriptors form level 10 to level 1.

6. REQUIRED COMPETENCIES AT EXIT LEVEL

According to the National Qualifications Framework (NQF), a Bachelor of Technology Degrees normally contains a substantial element of 'learning by doing' and often focuses on preparation for entry into an occupational field of practice, such as Engineering.

The required competencies or exit level outcomes of a graduate with a registered Bachelor of Technology Degree in Engineering are defined in sections 6.1 to 6.7.

The main difference between a Bachelor of Technology Degree in Engineering and a Professional Bachelor Degree in Engineering is that the Bachelor Degree in Engineering contains less basic sciences, mathematics and applied mathematics in its programme. A further difference is that the Bachelor Degree in Engineering's engineering science courses is focused on existing technology and not necessarily derived from first principles.

6.1 Engineering Problem Solving

The graduate engineer should be competent to apply engineering principles to systematically diagnose and solve **broadly defined** engineering problems:

(Problems are Stage 1 **broadly defined** engineering problems having some or all of the following characteristics.)

6.1.1 Problems require identification and analysis may be ill posed and have a degree of uncertainty.
6.1.2 Problems may be unfamiliar, but are capable of interpretation for solution by technologies in the practice area.
6.1.3 Approach solution using structured analysis techniques in well-accepted and innovative ways.
6.1.4 Information is complex and possibly incomplete, requires validation and supplementation and compilation into information base.
6.1.5 Solutions may be partially outside standards and codes, may require judgement, and may operate outside standards and codes with justification.
6.1.6 Involves a variety of factors that may impose conflicting constraints.

6.2 Application of Fundamental and Engineering Knowledge

The graduate engineer should be competent in demonstrating the application of mathematical, science and engineering knowledge in an engineering environment.

Characterisation of knowledge:

- 6.2.1 Coherent range of fundamental principles in mathematics, basic science and engineering science underlying a sub-discipline or recognised practice area.
- 6.2.2 Coherent range of fundamental principles in engineering science and technology underlying an engineering sub-discipline or recognised practice area.
- 6.2.3 Systematic body of knowledge in specialist area or recognised practice area.
- 6.2.4 Professional communication, social impact, environmental impact, cost analysis, quality procedures.
- 6.2.5 Use of engineering technology, supported by established models, physical principles and mathematics to aid solving technological problems.

6.3 Engineering Design and Synthesis

The graduate engineer should be competent in performing procedural and non-procedural design of broadly defined components, systems, works, products or processes to meet desired needs within applicable standards, codes of practice and legislation (*Design problems conform to the definition of Stage 1 broadly defined engineering problems.*).

- 6.3.1 Identify and analyse specific project objectives, and plan and formulate the criteria for an acceptable design solution.
- 6.3.2 Access, acquire and evaluate the relevant knowledge, information and resources.
- 6.3.3 Generate and analyse alternative solutions by applying appropriate engineering knowledge.
- 6.3.4 Select the optimal solution based on technical, operational and economic criteria, and evaluate the impacts and benefits of the proposed design.
- 6.3.5 Implement the solution.
- 6.3.6 Communicate the design logic and information in the appropriate format.

6.4 Investigations, Experiments and Data Analysis

The graduate engineer should be competent to apply appropriate investigative methods to a given engineering problem and:

- 6.4.1 Plan and conduct investigations and experiments using appropriate equipment.
- 6.4.2 Analyse, interpret and derive information from data.

6.5 Communication

Have a good command of written and spoken English.

Communicate technical, supervisory and general management information effectively, both orally and in writing, using appropriate language and terminology, structure, style and graphical support (*Communicate professional work to peers, other disciplines, client and stakeholder audiences, selecting appropriate modes of communication.*).

- 6.5.1 Generate and assemble appropriate data and information, using available resources.
- 6.5.2 Interpret technical data (*Technical books, Management manuals, Periodicals, Data packs, Technical, Research and Management reports.*).
- 6.5.3 Apply graphical techniques to present information effectively. (*Line graphs, histograms, pie charts, bar charts, line graphs, polar plots and 3D graphs.*).
- 6.5.4 Generate, construct and assemble technical documents (*Technical specifications and project reports.*).

6.5.5 Communicate interactively with individuals and with members of a group (*Meetings*.).
6.5.6 Generate, construct, assemble and deliver a technical presentation (*A multi-disciplinary audience. Project overviews and reports, end-results, conclusions and recommendations.*).

6.6 Engineering Management

Apply engineering management principles and concepts to engineering activities.

6.6.1 Apply entrepreneurial principles to engineering activities (P*roduct, service or process.*).
6.6.2 Practice engineering management principles (G*eneral engineering operations and at least two of the following: Quality assurance maintenance, procurement, operation, safety, environment, human resources.*).
6.6.3 Formulate and evaluate a project/process plan.

6.7 Project Development

Identify, analyse, conduct and manage an **industry-initiated** (At least 30 credits.) terminal project (*Investigation and/or research and development*) with outcomes consistent with at least Level 7 on the NQF.

6.7.1 Formulate a project.
6.7.2 Describe and justify the theoretical framework and methodology to address the project.
6.7.3 Conduct and manage the project.
6.7.4 Analyse the information gained/results of the project.
6.7.5 Draw conclusions and make recommendations based on the project.
6.7.6 Produce a report of the completed work.

6.8 Application of Complementary Knowledge

Demonstrate a critical awareness of the impact of engineering activity on the social, industrial and physical environment, and of the need to act professionally within own limits of competence (*The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the discipline or other designation of the qualification. Evidence may include case studies typical of engineering practice situations in which the graduate is likely to participate.*).

6.8.1 Relate engineering activity to environmental, cultural and safety issues.
6.8.2 Exhibit awareness of the need for professionalism.

REFERENCES:

(1) Regulations Setting-up the National Qualifications Framework for Namibia: Government Notice No. 125 of August 2006.

(2) Whole Qualification Standard for Bachelor of Technology Degree in Engineering: NQF Level 7): The Engineering Council of South Africa.

APPENDIX 1

DEFINITION OF KNOWLEDGE AREAS

1. Mathematics
This is an umbrella term embracing the techniques of mathematics, numerical analysis and statistics cast in an appropriate mathematical formulation.

2. Basic Sciences
Physics (including mechanics), chemistry, earth sciences and the biological sciences that focus on understanding the physical world, as applicable in each engineering disciplinary context.

3. Engineering Science and Principles
These are rooted in the applied mathematics and applied physical sciences, and where applicable, in other basic sciences, but extend knowledge and develop models and methods in order to lead to engineering applications and solve engineering problems.

4. Engineering Design and Synthesis
The creative, iterative and often open-ended process of conceiving and developing components, systems and processes. Design requires the integration of engineering, basic and mathematical sciences, working under constraints, taking into account economic, health and safety, social and environmental factors, codes of practice and applicable laws.

5. Computing and Information Technology
The use of computers, networking and software to support engineering activity, and as an engineering activity in itself, as appropriate to the discipline.

6. Complementary Studies
Those disciplines outside of engineering sciences, basic sciences and mathematics which:
- Are essential to the practice of engineering, including engineering economics, the impact of technology on society and effective communication; and
- Broaden the student's perspective in the humanities and social sciences in order to understand the world in which engineering is practiced.

7. Discretionary Studies
These include any **cross**-discipline supportive courses drawn from engineering sciences, basic sciences or mathematics.
For example a student of mechanical engineering may opt to study the course "Electrical Machines and Drives" as a supportive course, although this is not compulsory in his/her discipline.

APPENDIX 2

Indicative Fundamental Engineering Science and Principles Content for Designated Disciplines

DISCIPLINE / COURSE	Aeronautical	Agricultural	Chemical	Civil	Electronic	Electrical	Industrial	Mechanical	Mechatronics	Metallurgical (Extraction)	Metallurgical (Physical)	Mining
Aerodynamics & Aircraft structures	□											
Chemical Reactor Theory			□									
Computer Engineering					□	□			□			
Dynamics	□	□				□	□	□	□			□
Electric Circuits					□	□			□			
Electric Power					□	□			□			□
Electromagnetic Circuits					□							
Electronics					□	□			□			
Feedback systems/Control			□		□	□			□			
Flight Dynamics & Propulsion Systems	□											
Fluid Mechanics	□	□	□	□				□	□			
Heat Transfer	□		□					□		□	□	□
Human Factors		□					□					
Hydraulics		□		□								□
Instrumentation/Measurement	□				□	□		□	□			
Kinetics (Metallurgical)			□							□		
Linear Systems			□		□							
Manufacturing Technology							□				□	
Mass Transfer			□							□		
Material Processes			□				□			□		
Materials	□	□	□	□	□	□	□	□	□	□	□	□
Momentum transfer										□		
Operations Technology	□						□					
Particulate Systems		□	□							□		
Separation Processes		□	□							□		
Signals and Signal Processing					□							
Soil Mechanics		□		□								□
Solid Mechanics	□	□		□		□	□	□			□	□
Strength of Material	□	□	□	□		□	□	□			□	□
Structural Analysis	□			□								
Surveying				□								□
Thermodynamics	□	□	□			□		□	□	□	□	□
Mining Methods & Mine Machinery												□
Technical Valuation &Financial Valuation												□

APPENDIX 3

CALCULATION OF CREDITS AND ALLOCATION TO KNOWLEDGE AREA

The method of calculation assumes that certain activities are scheduled on a regular weekly basis while others can only be quantified as a total activity over the duration of a course or module. This calculation makes the following assumptions:

1. Classroom or other scheduled contact activity generates notional hours of the student's own time for each hour of scheduled contact. The total is given by a multiplier (see third column of table below) applied to the contact time.
2. One week of full time activity accounts for assessments in a semester.
3. Assigned work generates only the notional hours judged to be necessary for completion of the work and is not multiplied.

Define the following for each course or module:

Type of Activity	Time Unit in hours	Contact time multiplier
L = number of lectures per week	T_L = duration of a lecture period	M_L = total work per lecture period
T = number of tutorial per week	T_T = duration of a tutorial period	M_T = total work per tutorial period
P = total practical periods	T_P = duration of an institution-based practical period	M_P = total work per practical period
X = total other contact periods	T_X = duration of other period	M_X = total work per other period
A = total assignment non-contact hours	T_A = 1 hour	
D = total no of days of workplace-based learning	T_D = duration of work-based learning per day	M_D = total workplace-based learning per period.
W = number of weeks the course lasts		

The credit for the course is calculated using the formula:

$$\boldsymbol{C = \{W(LT_L\,M_L + TT_T\,M_T) + PT_P\,M_P + XT_X\,M_X + AT_A + DT_DM_D\}/10}$$

The resulting credit for a course or value may be divided between more than one knowledge areas. In allocating the credit for a course to multiple knowledge areas, only new knowledge or skills in a particular area may be counted. Knowledge and skills developed in other courses and used in the course in question shall not be counted. Such knowledge is classified by the nature of the area in which it is applied. In summary, no knowledge is counted more than once as being new.

M_D may differ for different activities e.g. the factor for work-based learning component in which the learner develops skills which integrate theoretical knowledge with actual practice in a working environment will differ from the factor for a related assignment and project work which enhances learner understanding of the work environment and/or new learning.

X includes all other contact activities such as **assessment**.

All learning that is assigned credits must satisfy the following criteria:

- The competencies to be achieved and contributions to knowledge areas are clearly defined and documented.
- The learning is quality assured by the provider.
- A student's performance is assessed against defined outcomes.
- Evidence of the assessment process is presented in the accreditation evaluation.

APPENDIX 4

LEVEL DESCRIPTORS FOR THE NATIONAL QUALIFICATIONS FRAMEWORK

Level	Descriptor
10	Comprehensive, systematic and in-depth mastery of a discipline/field's knowledge, research, analytical and/or creative requirements. Able to contribute ideas and to debate at the cutting edge of an area of specialisation. Highest level of research capabilities and/or in the creation of new knowledge art or work. Provide through publication and/or presentation an original contribution to knowledge through research or scholarship, as judged by independent experts and peers applying international standards.
9	Comprehensive and systematic knowledge in a discipline or field with specialist knowledge in an area at the forefront of that discipline or field. Capacity for self-directed study and the ability to work independently. Planning and carrying out of a substantial piece of original research or scholarship to internationally recognised standards and involving a high order of skill in analysis and critical evaluation. Identification, analysis and proposed responses to real world or complex issues and problems drawing systematically and creatively on the principles, theories and methodologies of a particular discipline. Advanced information retrieval, processing, analytical, synthesising and independent evaluation of quantitative and qualitative data. Able to present and communicate academic or professional work effectively, catering for a wide range of specialist and non-specialist audiences and/or in diverse genres.
8	Deepened, comprehensive and systematic expertise in a particular discipline. Developed research capacity using a coherent and critical understanding of the principles, theories and methodologies of a particular discipline. Selects research methods, techniques and technologies appropriate to a particular problem. Efficient and effective information retrieval and processing skills, involving critical analysis and independent evaluation of quantitative and qualitative data. Engages with current research and scholarly or professional literature. Able to present and communicate academic or professional work effectively, catering for a wide range of audiences and/or in diverse genres.
7	Knowledge of a major discipline with areas of specialisation in depth. Analysis, transformation and evaluation of abstract data and concepts in the creation of appropriate responses to resolve given or contextual abstract problems. Carry out processes that require a command of highly specialised technical or scholastic and basic research skills across a major discipline and which involve the full range of procedures in a major discipline. Application in complex, variable and specialised contexts. Planning, resourcing and managing processes within broad parameters and functions with complete accountability for determining, achieving and evaluating personal and/or group outcomes.
6	Demonstrates focussed knowledge and skills in a particular field using general principles and application and/or some specialised knowledge with depth in more than one area. Analysis, reformatting and evaluation of a wide range of information used in the formulation of appropriate responses to resolve both concrete and abstract problems. Carry out processes that require a command of wide-ranging highly specialised technical or scholastic skills and/or which involve a wide choice of standard and non-standard procedures, often in non-standard combinations, often in highly variable routine and non-routine contexts. Manages processes within broad parameters for defined activities. Complete accountability for determining and achieving personal and/or group outcomes.

5	Broad, general knowledge based on general principle in a specific area with substantial depth in some aspects. Analytical interpretation of a wide range of data and the determination of appropriate methods and procedures in response to a range of concrete problems with some theoretical elements. Carry out processes that require a wide range of specialised technical or scholastic skills involving a wide choice of standard and non-standard procedures. Employed in a variety of routine and non-routine contexts. Self-directed and sometimes directive activity within broad general guidelines or functions. Full responsibility for the nature, quantity and quality of outcomes, with possible responsibility for the achievement of group outcome.
4	Employing a broad knowledge base incorporating some theoretical concepts or in-depth applied knowledge and skills in a specific area. Analytical interpretation of information. Making informed judgement and offers a range of sometimes-innovative responses to concrete but often unfamiliar problems. Carry out processes that require a wide range of technical or scholastic skills and/or that offer a considerable choice of procedures. Often employed in a variety of familiar and unfamiliar contexts. Applied in self-directed activity under broad guidance and evaluation. Complete responsibility for quantity and quality of output, with possible responsibility for the quantity and quality of the output of others.
3	Employing some relevant theoretical knowledge and interpretation of available information. Uses discretion and judgement over a range of known responses to familiar problems. Carry out processes that require a range of well-developed skills and offer a significant choice of procedures within a range of familiar contexts. Applied in directed activity with some autonomy. Under general supervision and quality checking, though with significant responsibility for the quantity and quality of output, with possible responsibility for the output of others.
2	Employs basic operational knowledge using readily available information. Uses known solutions to familiar problems with little generation of new ideas. Carry out processes that are moderate in range, are established and familiar and offer a clear choice of routine responses. Applied in directed activity under general supervision and quality control. Some responsibility for quantity and quality, with possible responsibility for guiding others.
1	Employs recall and a narrow range of knowledge and cognitive skills. No generation of new ideas. Carry out processes that are limited in range, repetitive and familiar, and employed within closely defined contexts. Applied in directed activity under close supervision with no responsibility for the work or learning of others.