Unit ID: 882

Domain **ELECTROTECHNOLOGY**

Title: **Apply basic knowledge of analogue and digital electronics**

Level: 2 **Credits: 4**

Purpose

This unit standard specifies the competencies required to apply basic knowledge of analogue and digital electronics. It includes the fundamentals of analogue and digital electronics, processes, common logic families and common integrated circuits, together with analogue to digital (A/D) and digital to analogue (D/A) conversion. This unit standard is intended for those who work in electrotechnology work environment.

Special Notes

1. Entry information:

   Prerequisite
   - Unit 864 - *Apply safety rules and regulations in an electrotechnology environment* or demonstrated equivalent knowledge and skills.

2. Assessment evidence may be collected from a real workplace or an appropriate simulated realistic environment in which electrical operations are carried out.

3. Performance of all elements in this unit standard must comply with manufacturers' specifications, workplace specific requirements and reasonable.

4. Glossary of terms:
   - *'A/D and D/A'* refers to signal conversion of analogue to digital and digital to analogue respectively.

5. Regulations and legislation relevant to this unit standard include the following:
   - Labour Act, No. 11, 2007
   - Occupational Health and Safety Regulations No. 18, 1997 and all subsequent amendments.

Quality Assurance Requirements

This unit standard and others within this subfield may be awarded by institutions which meet the accreditation requirements set by the Namibia Qualifications Authority and the Namibia Training Authority and which comply with the national assessment and moderation requirements. Details of specific accreditation requirements and the national assessment arrangements are available from the Namibia Qualifications Authority and the Namibia Training Authority. All approved unit standards, qualifications and national assessment arrangements are available on the Namibia Training Authority website www.nta.com.na

Elements and Performance Criteria

Element 1: Demonstrate knowledge of fundamentals of analogue electronics.

Range

Fundamentals of analogue electronics may include but are not limited to basic concept, signal processing, electrical behaviour of components, characteristic curves, device specifications and operating conditions, circuit parameters, rectification, methods of biasing, gains, circuit configurations and applications.

Performance Criteria

1.1 The use of diodes in analogue electronics is explained.

1.2 The use of transistors in analogue electronics is explained.

1.3 Operational amplifiers and their applications are described.

1.4 Applications of opto-electronic devices and linear DC regulators are described.

Element 2: Demonstrate knowledge of fundamentals of digital electronics.

Range

Fundamentals of digital concepts may include but are not limited to main features, purpose and use of concepts, characteristics of associated scientific rules, logic and formulae and supporting practical examples providing valid illustrations of the concepts.

Functions of combined logic circuits may include but not limited to mathematical or logical manipulation, computation and presentation and the application process should demonstrate valid and logical use of technology concepts, rules, formulae and data in carrying out tests, experiments and problems.

Logic gates to include: NOT, NOR, OR, AND, NAND, Exclusive OR (XOR) and Exclusive Not OR (XNOR).

Applicable laws and codes may include but are not limited to Boolean expression, Boolean algebra, Karnaugh, De Morgan's theorem and Gray code, 8421, 2421, binary-coded decimal (BCD), American Standard Code for Information Interchange (ASCII), Excess-3 and Hamming codes.

Performance Criteria

2.1 Basic digital electronic concepts are described.

2.2 Analogue and digital signals are distinguished and described.

2.3 Logic state representations are explained.

2.4 Basic logic gates, symbols and their functions are explained.

2.5 Applicable laws and codes are explained and applied where possible.

2.6 Functions of combined logic circuits are described and circuit diagrams drawn using appropriate symbols, Boolean expression and truth table.

Element 3: Demonstrate knowledge of digital and analogue processes.

Performance Criteria

3.1 Analogue and digital signals (waveforms) are described and compared in graphic illustration.

3.2 The number systems are explained.

3.3 Calculations in terms of addition, subtraction, division and multiplication of binary numbers are carried out.

3.4 Encoding of information in a digital waveform is described in simple terms.

3.5 Truth table is constructed and circuit diagram is sketched using logic gates.

Element 4: Demonstrate knowledge of common logic families and circuits.

Performance Criteria

4.1 Common families such as transistor transistor logic (TTL) and complementary metal-oxide-semiconductor **(**CMOS) are described.

4.2 Behaviour and handling of CMOS devices is described.

4.3 Sequential logic circuits and their operational principles are explained and their respective circuits are drawn.

4.4 Voltage gains and input and output impedance are calculated from given inverting and non-inverting amplifier circuits.

4.5 Output voltages are calculated from summing and subtructor amplifiers.

4.6 Inverting and non-inverting amplifier circuits are constructed and their voltage gains confirmed by measurement.

4.7 Summing and subtructor amplifier circuits are constructed and their output voltages confirmed by measurement.

4.8 Truth tables for half and full adders are constructed and their diagrams and symbols are sketched using logic gates.

4.9 Integrated circuit pulse generators and timers are identified from given circuit diagrams, and their operation described with reference to the function of each major component.

4.10 Calculations of waveforms width, frequency, duty cycle and mark-space are performed using data sheets.

Element 5: Demonstrate knowledge of A/D and D/A conversion.

Range

Terms associated with A/D conversion D/A and conversion may include but are not limited to flash, successive approximation, dual slope, resolution, quantization, quantization error, coding conversion time, clock pulse, linearity, delay, output pulse train, sampling, zero cross error, oversampling, bit, filter coefficient, multiplier and applicable conversion laws.

A/D and D/A conversion scope may include but is not limited to characteristics, sample and hold, conversion time, clock, sampling, cut-off frequency, multiplier, accumulator and conversion laws.

Performance Criteria

5.1 Terms associated with A/D and D/A conversion and converters are explained.

5.2 A/D conversion is explained with the aid of diagrams.

5.3 D/A conversion are explained with the aid of diagrams.

5.4 A/D and D/A converter types are identified from schematic diagrams.

5.5 A/D and D/A converter applications are described.

5.6 Technical differences between A/D and D/A converters are identified and described.

Registration Data

Subfield:	Electrical Engineering
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