NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

ELECTRO TECHNOLOGY

NQF Level 4

April 2008

CONTENTS

SECTION A: PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

This document provides the lecturer with guidelines to develop and implement a coherent, integrated assessment system for Electro Technology in the National Certificates (Vocational). It must be read with the *National Policy Regarding Further Education and Training Programmes: Approval of the Documents, Policy for the National Certificates (Vocational) Qualifications at Levels 2 to 4 on the National Qualifications Framework (NQF)*. This assessment guideline will be used for National Qualifications Framework Levels 2-4.

This document explains the requirements for the internal and external subject assessment. The lecturer must use this document with the *Subject Guidelines: Electro Technology* to prepare for and deliver Electro Technology. Lecturers should use a variety of resources and apply a range of assessment skills in the setting, marking and recording of assessment tasks.

SECTION B: ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

1 ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

Assessment in the National Certificates (Vocational) is underpinned by the objectives of the National Qualifications Framework (NQF). These objectives are to:

- Create an integrated national framework for learning achievements.
- Facilitate access to and progression within education, training and career paths.
- Enhance the quality of education and training.
- Redress unfair discrimination and past imbalances and thereby accelerate employment opportunities.
- Contribute to the holistic development of the student by addressing:
  - social adjustment and responsibility;
  - moral accountability and ethical work orientation;
  - economic participation; and
  - nation-building.

The principles that drive these objectives are:

- ***Integration***

To adopt a unified approach to education and training that will strengthen the human resources development capacity of the nation.

- ***Relevance***

To be dynamic and responsive to national development needs.

- ***Credibility***

To demonstrate national and international value and recognition of qualification and acquired competencies and skills.

- ***Coherence***

To work within a consistent framework of principles and certification.

- ***Flexibility***

To allow for creativity and resourcefulness when achieving Learning Outcomes, to cater for different learning styles and use a range of assessment methods, instruments and techniques.

- ***Participation***

To enable stakeholders to participate in setting standards and co-ordinating the achievement of the qualification.

- ***Access***

To address barriers to learning at each level to facilitate students' progress.

- ***Progression***

To ensure that the qualification framework permits individuals to move through the levels of the national qualification via different, appropriate combinations of the components of the delivery system.

- ***Portability***

To enable students to transfer credits of qualifications from one learning institution and/or employer to another institution or employer.

- ***Articulation***

To allow for vertical and horizontal mobility in the education system when accredited pre-requisites have been successfully completed.

- ***Recognition of Prior Learning***

To grant credits for a unit of learning following an assessment or if a student possesses the capabilities specified in the outcomes statement.

- ***Validity of assessments***

To ensure assessment covers a broad range of knowledge, skills, values and attitudes (SKVAs) needed to demonstrate applied competency. This is achieved through:

  - clearly stating the outcome to be assessed;
  - selecting the appropriate or suitable evidence;
  - matching the evidence with a compatible or appropriate method of assessment; and
  - selecting and constructing an instrument(s) of assessment.

- ***Reliability***

To assure assessment practices are consistent so that the same result or judgment is arrived at if the assessment is replicated in the same context. This demands consistency in the interpretation of evidence; therefore careful monitoring of assessment is vital.

- ***Fairness and transparency***

To verify that no assessment process or method(s) hinders or unfairly advantages any student. The following could constitute unfairness in assessment:

  - Inequality of opportunities, resources or teaching and learning approaches
  - Bias based on ethnicity, race, gender, age, disability or social class
  - Lack of clarity regarding Learning Outcome being assessed
  - Comparison of one student's work with another, based on learning styles and language

- ***Practicability and cost-effectiveness***

To integrate assessment practices within an outcomes-based education and training system and strive for cost and time-effective assessment.

2 ASSESSMENT FRAMEWORK FOR VOCATIONAL QUALIFICATIONS

The assessment structure for the National Certificates (Vocational) qualification is as follows:

2.1 Internal continuous assessment (ICASS)

Knowledge, skills values, and attitudes (SKVAs) are assessed throughout the year using assessment instruments such as projects, tests, assignments, investigations, role-play and case studies. The internal continuous assessment (ICASS) practical component is undertaken in a real workplace, a workshop or a "Structured Environment". This component is moderated internally, and externally quality assured by Umalusi. All internal continuous assessment evidence is kept in a Portfolio of Evidence (PoE) and must be readily available for monitoring, moderation and verification purposes.

2.2 External summative assessment (ESASS)

The external summative assessment is either a single paper or set of written papers set to the requirements of the Subject Learning Outcomes. The Department of Education administers the theoretical component according to relevant assessment policies.

A compulsory component of external summative assessment (ESASS) is the **integrated summative assessment task (ISAT)**. This assessment task draws on the student's cumulative learning throughout the year. The task requires **integrated application of competence** and is executed under strict assessment conditions. The task should take place in a simulated or "Structured Environment". The integrated summative assessment task is the most significant test of students' ability to apply acquired knowledge.

The integrated assessment approach allows students to be assessed in more than one subject with the same integrated summative assessment task.

External summative assessments will be conducted annually between October and December, with provision made for supplementary sittings.

3 MODERATION OF ASSESSMENT

3.1 Internal moderation

Assessment must be moderated according to the internal moderation policy of the Further Education and Training (FET) college. Internal college moderation is a continuous process. The moderator's involvement starts with the planning of assessment methods and instruments and follows with continuous collaboration with and support to the assessors. Internal moderation creates common understanding of Assessment Standards and maintains these across vocational programmes.

3.2 External moderation

External moderation is conducted by the Department of Education, Umalusi and, where relevant, an Education and Training Quality Assurance (ETQA) body according to South African Qualifications Authority (SAQA) and Umalusi standards and requirements.

The external moderator:

- monitors and evaluates the standard of all summative assessments;
- maintains standards by exercising appropriate influence and control over assessors;
- ensures proper procedures are followed;
- ensures summative integrated assessments are correctly administered;
- observes a minimum sample of ten (10) to twenty-five (25) percent of summative assessments;
- gives written feedback to the relevant quality assuror; and
- moderates in case of a dispute between an assessor and a student.

Policy on inclusive education requires that assessment procedures be customised for students who experience barriers to learning, and supported to enable these students to achieve their maximum potential.

4 PERIOD OF VALIDITY OF INTERNAL CONTINUOUS ASSESSMENT (ICASS)

The period of validity of the internal continuous assessment mark is determined by the *National Policy on the Conduct, Administration and Management of the Assessment of the National Certificates (Vocational).*

The internal continuous assessment (ICASS) must be re-submitted with each examination enrolment for which it constitutes a component.

5 ASSESSOR REQUIREMENTS

Assessors must be subject specialists and should ideally be declared competent against the standards set by the ETDP SETA. If the lecturer conducting the assessments has not been declared a competent assessor, an assessor who has been declared competent may be appointed to oversee the assessment process to ensure the quality and integrity of assessments.

6 TYPES OF ASSESSMENT

Assessment benefits the student and the lecturer. It informs students about their progress and helps lecturers make informed decisions at different stages of the learning process. Depending on the intended purpose, different types of assessment can be used.

6.1 Baseline assessment

At the beginning of a level or learning experience, baseline assessment establishes the knowledge, skills, values and attitudes (SKVAs) that students bring to the classroom. This knowledge assists lecturers to plan learning programmes and learning activities.

6.2 Diagnostic assessment

This assessment diagnoses the nature and causes of learning barriers experienced by specific students. It is followed by guidance, appropriate support and intervention strategies. This type of assessment is useful to make referrals for students requiring specialist help.

6.3 Formative assessment

This assessment monitors and supports teaching and learning. It determines student strengths and weaknesses and provides feedback on progress. It determines if a student is ready for summative assessment.

6.4 Summative assessment

This type of assessment gives an overall picture of student progress at a given time. It determines whether the student is sufficiently competent to progress to the next level.

7 PLANNING ASSESSMENT

An assessment plan should cover three main processes:

7.1 Collecting evidence

The assessment plan indicates which Subject Outcomes and Assessment Standards will be assessed, what assessment method or activity will be used and when this assessment will be conducted.

7.2 Recording

Recording refers to the assessment instruments or tools with which the assessment will be captured or recorded. Therefore, appropriate assessment instruments must be developed or adapted.

7.3 Reporting

All the evidence is put together in a report to deliver a decision for the subject.

8 METHODS OF ASSESSMENT

Methods of assessment refer to who carries out the assessment and includes lecturer assessment, self-assessment, peer assessment and group assessment.

LECTURER ASSESSMENT	The lecturer assesses students' performance against given criteria in different contexts, such as individual work, group work, etc.
SELF-ASSESSMENT	Students assess their own performance against given criteria in different contexts, such as individual work, group work, etc.
PEER ASSESSMENT	Students assess another student's or group of students' performance against given criteria in different contexts, such as individual work, group work, etc.
GROUP ASSESSMENT	Students assess the individual performance of other students within a group or the overall performance of a group of students against given criteria.

9 INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE

All evidence collected for assessment purposes is kept or recorded in the student's Portfolio of Evidence (PoE).

The following table summarises a variety of methods and instruments for collecting evidence. A method and instrument is chosen to give students ample opportunity to demonstrate that the Subject Outcome has been attained. This will only be possible if the chosen methods and instruments are appropriate for the target group and the Specific Outcome being assessed.

	METHODS FOR COLLECTING EVIDENCE		
	Observation-based (Less structured)	**Task-based** (Structured)	**Test-based** (More structured)
Assessment instruments	• Observation • Class questions • Lecturer, student, parent discussions	• Assignments or tasks • Projects • Investigations or research • Case studies • Practical exercises • Demonstrations • Role-play • Interviews	• Examinations • Class tests • Practical examinations • Oral tests • Open-book tests
Assessment tools	• Observation sheets • Lecturer's notes • Comments	• Checklists • Rating scales • Rubrics	• Marks (e.g. %) • Rating scales (1-5)
Evidence	• Focus on individual students • Subjective evidence based on lecturer observations and impressions	**Open middle**: Students produce the same evidence but in different ways. **Open end**: Students use same process to achieve different results.	Students answer the same questions in the same way, within the same time.

10 TOOLS FOR ASSESSING STUDENT PERFORMANCE

Rating scales are marking systems where a symbol (such as 1 to 5) or a mark (such as 5/10 or 50%) is defined in detail. The detail is as important as the coded score. Traditional marking, assessment and evaluation mostly used rating scales without details such as what was right or wrong, weak or strong, etc.

Task lists and **checklists** show the student what needs to be done. These consist of short statements describing the expected performance in a particular task. The statements on the checklist can be ticked off when the student has adequately achieved the criterion. Checklists and task lists are useful in peer or group assessment activities.

Rubrics are a hierarchy (graded levels) of criteria with benchmarks that describe the minimum level of acceptable performance or achievement for each criterion. Using rubrics provides a different way of assessing that cannot be compared to tests. Each criterion described in the rubric must be assessed separately. Mainly two types of rubrics, namely holistic and analytical, are used.

11 SELECTING AND/OR DESIGNING RECORDING AND REPORTING SYSTEMS

The selection or design of recording and reporting systems depends on the purpose of recording and reporting student achievement. **Why** particular information is recorded and **how** it is recorded determine which instrument will be used.

Computer-based systems, for example spreadsheets, are cost and time effective. The recording system should be user-friendly and information should be easily accessed and retrieved.

12 COMPETENCE DESCRIPTIONS

All assessment should award marks to evaluate specific assessment tasks. However, marks should be awarded against rubrics and not be simply a total of ticks for right answers. Rubrics should explain the competence level descriptors for the skills, knowledge, values and attitudes (SKVAs) that a student must demonstrate to achieve each level of the rating scale.

When lecturers or assessors prepare an assessment task or question, they must ensure that the task or question addresses an aspect of a Subject Outcome. The relevant Assessment Standard must be used to create the rubric to assess the task or question. The descriptions must clearly indicate the minimum level of attainment for each category on the rating scale.

13 STRATEGIES FOR COLLECTING EVIDENCE

A number of different assessment instruments may be used to collect and record evidence. Examples of instruments that can be (adapted and) used in the classroom include:

13.1 Record sheets

The lecturer observes students working in a group. These observations are recorded in a summary table at the end of each project. The lecturer can design a record sheet to observe students' interactive and problem-solving skills, attitudes towards group work and involvement in a group activity.

13.2 Checklists

Checklists should have clear categories to ensure that the objectives are effectively met. The categories should describe how the activities are evaluated and against which criteria they are evaluated. Space for comments is essential.

SECTION C: ASSESSMENT IN ELECTRO TECHNOLOGY

1 SCHEDULE OF ASSESSMENT

At NQF levels 2, 3 and 4, lecturers will conduct assessments as well as develop a schedule of formal assessments that will be undertaken in the year. All three levels also have an external examination that accounts for 50 percent of the total mark. The marks allocated to assessment tasks completed during the year, kept or recorded in a Portfolio of Evidence account for the other 50 percent.

The Portfolio of Evidence and the external assessment include practical and written components. The practical assessment in Electro Technology must, where necessary, be subjected to external moderation by Umalusi or an appropriate Education and Training Quality Assurance (ETQA) body, appointed by the Umalusi Council in terms of Section 28(2) of the *General and Further Education and Training Quality Assurance Act, 2001 (Act No. 58 of 2001).*

2 RECORDING AND REPORTING

Electro Technology, as is the case for all the other Vocational subjects, is assessed according to five levels of competence. The level descriptions are explained in the following table.

Scale of Achievement for the Vocational component

RATING CODE	RATING	MARKS %
5	Outstanding	80-100
4	Highly competent	70-79
3	Competent	50-69
2	Not yet competent	40-49
1	Not achieved	0-39

The programme of assessment should be recorded in the Lecturer's Portfolio of Assessment for each subject. The following at least should be included in the Lecturer's Assessment Portfolio:

- A contents page
- The formal schedule of assessment
- The requirements for each assessment task
- The tools used for each assessment task
- Recording instrument(s) for each assessment task
- A mark sheet and report for each assessment task

The college must standardise these documents.

The student's Portfolio of Evidence must include at least:

- A contents page
- The assessment tasks according to the assessment schedule
- The assessment tools or instruments for the task
- A record of the marks (and comments) achieved for each task

Where a task cannot be contained as evidence in the Portfolio of Evidence, its exact location must be recorded and it must be readily available for moderation purposes.

The following units guide internal assessment in Electro Technology Level 4:

NUMBER OF UNITS	ASSESSMENT	COVERAGE
3	Formal written tests	One or more completed topics
1	Internal written exam	All completed topics
3	Practical assessments	Must cover the related Subject Outcomes 1.1 Three-phase motor types connected in delta and star configurations and basic inspections and tests on 3-phase AC drives. 2.1 Modification of existing contactor control circuits to solve drive related problems, the selection of appropriate control and switch gears and on adjusting and programming related sensors. 3.1 The setting up of a complete circuit and testing for function, application of relevant speed control and the levelling of various electric drive types for system application. 4.1 The modification of contactor control circuits to PLC control, to meet new safety regulations and to improve productivity and quality. 5.1 The preparation of devices, equipment, components and materials for assembling, application of safety measures and checks, detection of errors in analogue and digital circuitry, repair and replacement of faulty parts and maintenance

ASSESSMENT OF ELECTRO TECHNOLOGY

LEVEL 4

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN ELECTRO TECHNOLOGY – LEVEL 4

Topic 1: Describe the fundamentals of three-phase machines and speed control in electrical drives

<table>
<tr><th colspan="2">SUBJECT OUTCOME</th></tr>
<tr><td colspan="2">1.1 Describe three-phase electrical drive technology
Range: Fundamentals: three-phase principles. Electric drive types: AC drives: synchronous and asynchronous. Terminology: Induction motors; Rotating magnetic field; Slip; Star configuration; Delta configuration</td></tr>
<tr><th>ASSESSMENT STANDARDS</th><th>LEARNING OUTCOMES</th></tr>
<tr><td>• The fundamental operation of three phase electric AC drives is described.
• The basic construction of three phase electric AC drives is identified and described.
• Control application of the various three-phase electric drive types is described.
• Advantages and disadvantages of thee-phase AC drives are listed.
• The importance of name plates is explained and the meaning of given information indicated.
• A description of the ways different terminal connections can be made to connect star and delta three-phase motors is given.
• IP and temperature ratings on various AC motor types are explained.
• Various methods and procedures of mounting three-phase electric drives are explained.
• Three-phase related terminology is explained.
• Construction of the various three-phase AC electric drive types is explained with the aid of drawings.
• Defects that might occur on an AC motor (mechanical and electrical), and the related inspection procedures and tests are listed.
• The correct three-phase drive is selected by means of the name plate.
• Three-phase motor types are connected in delta and star configurations.
• A motor is selected in accordance with application, power and torque requirements.
• Electric drive efficiency is determined by means of calculation.
• Basic inspections and tests are performed on three-phase AC drives.</td><td>• Describe
▪ the fundamental operation of three phase electric AC drives
▪ and identify the basic construction of three phase electric AC drives
▪ the control application of the various three-phase electric drive types
• List the advantages and disadvantages of three-phase AC drives
• Explain the importance of name plates and indicate the meaning of given information
• Describe how different terminal connections can be made to connect (star/delta) three-phase motors
• Explain
▪ the IP and temperature rating on various AC motor types
▪ the various methods and procedures of mounting three-phase electric drives
▪ three-phase related terminology.
▪ with the aid of drawings the construction of the various three-phase AC electric drive types
• List the possible defects that might occur in an AC motor (mechanical and electrical) and the related inspection procedures and tests
• Select the correct three-phase drive by means of the name plate
• Connect three-phase motor types in delta and/or star configurations
• Select a motor in accordance with application and power requirements and/or torque requirements
• Determine by calculation electric drive efficiency
• Perform basic inspections and tests on three-phase AC drives</td></tr>
<tr><th colspan="2">ASSESSMENT TASKS OR ACTIVITIES</th></tr>
<tr><td colspan="2">• Assignments or tasks on the description of three-phase electrical drive technology.
• Projects on drawings of the construction of three-phase AC electric drive types and calculations of electric drive efficiency.
• Practical exercises on three-phase motor types connected in delta and star configurations and basic inspections and tests on three-phase AC drives</td></tr>
</table>

SUBJECT OUTCOME	
1.2 Describe electric drive speed control technology *Range: Transistor chopper; Thyristor control; Power electronic converters; Switching control; PWM; Inverter switching; Microprocessor speed control*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The operation of various electric drive speed control types is identified and described. • Electronic and microprocessor speed controllers are identified and set up. • Drive speed is determined by means of calculation and loading requirements. • Electric speed control types are identified as per instruction/application.	• Identify ▪ and describe the operation of various electric drive speed control types. ▪ and set up electronic and micro-processor speed controllers. • Determine drive speed by means of calculation and loading requirements. • Identify electric speed control types as per instruction/application.
ASSESSMENT TASKS OR ACTIVITIES	
• Case studies, demonstrations, observation sheets and checklists on the description of electric drive speed control technology.	

Topic 2: Design and modify three-phase electric drive control circuits

SUBJECT OUTCOME	
2.1 Design and modify three-phase electrical drive control engineering technology *Range: Contactor circuits: Control of motor (automatic control); Control of motor from two actuators; Contactor circuit with motor protection relay and fault signal; Jumper of a motor protective relay during start up; Automatic KUSA circuit; Reversing contactor circuit; Automatic reversing contactor; Positive sequence starting; Dahlander circuit; Pendulum contactor circuit with delay; Automatic star-delta control; Automatic two step starting circuit of a three-phase induction motor with slip ring rotor*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Listed contactor circuit operation and function are drawn and explained. • Component functions and purposes in the various listed contactor control circuits are listed, described and discussed. • The various control and switch gears used in related control applications are listed and described. • Safety features related to three-phase control applications are listed and described. • The various components used for contactor control circuits are identified and listed. • Existing contactor control circuits are modified to solve drive related problems such as simplification and safety regulation. • Appropriate control and switch gears are selected. • Related sensors are adjusted and programmed.	• Draw and explain the operation and function of listed contactor circuits • List and describe ▪ the component functions and purposes in the various listed contactor control circuits ▪ the various control and switch gears used in related control applications ▪ safety features related to three phase control applications • Identify and list the various components used for contactor control circuits • Modify the existing contactor control circuit to solve drive related problems (simplification, safety regulation) • Select appropriate control and switch gears • Adjust and programme related sensors
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks, class questions and checklists on the design of three-phase electric drive control circuits. • Demonstrations and practical exercises on modification of existing contactor control circuits to solve drive related problems, the selection of appropriate control and switch gears and on adjusting and programming related sensors	

Topic 3: Install and test electro-technical systems that employ electrical drives, switches, control gears and speed control devices

SUBJECT OUTCOME	
3.1 Plan, install and test three-phase electric drive control systems	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The installation procedure of three-phase control circuits (input elements, protection devices, control/ linking elements and operating elements to be controlled) is planned. • The function of the control circuit (switching on/off) is described. • Emergency stops, and the difference between manual and software driven electronic speed control devices, are explained. • A materials list of electrical component requirements for three-phase electrical drive control applications is drawn up. • A complete circuit is set up and tested for function while relevant safety is applied. • Relevant speed control to task is applied if and when required. • Relevant speed control, whether manual electronic control or software electronic control is set up. • Various electric drive types are set up and levelled for system application. • The drive system is adjusted to meet quality standards. • Problems are identified and appropriate action taken.	• Plan the installation procedure of three-phase control circuits (input elements, protection devices, control/ linking elements and operating elements to be controlled) • Describe the function of the control circuit (switching on/off) • Explain ▪ what an emergency stop is ▪ the difference between manual and software driven electronic speed control devices • Draw up a materials list of electrical component requirements for three-phase electrical drive control applications • Set up the complete circuit and test for function (apply relevant safety) • Apply relevant speed control to task if and when required • Set up ▪ relevant speed control, be it manual electronic control or software electronic control ▪ and level various electric drive types for system application • Adjust drive system to meet quality standards • Identify any problems and take appropriate action
ASSESSMENT TASKS OR ACTIVITIES	
• A project with rating scales on the installation procedure of three-phase control circuits, functions of the control circuit, an emergency stop, the difference between manual and software driven electronic speed control devices, and a materials list of electrical component requirements for three-phase electrical drive control applications. • Case studies and practical exercises on the setting up of a complete circuit, testing for function, application of relevant speed control, and the levelling of various electric drive types for system application. • Observation sheets and rubrics on adjusting drive systems to meet quality standards, identification of problems and appropriate action.	

Topic 4: Modify three-phase electrical drive control technology circuits into PLC controlled applications

SUBJECT OUTCOME	
4.1 Apply and modify PLC analogy of electrical three phase drive technology control circuits	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The importance of modifying existing contactor control circuits to PLC based control applications is explained. • The importance of understanding relay control logic circuits is explained. • The meaning of final drive control components is explained and these components listed. • The meaning of smart sensors is explained. • Contactor control circuits are modified to PLC control, to meet new safety regulations, and to improve productivity and quality.	• Explain ▪ why it is important to modify existing contactor control circuits to PLC based control applications ▪ the importance of understanding relay control logic circuits ▪ what is meant by final drive control components and list these components ▪ what is meant by smart sensors • Modify contactor control circuits ▪ to PLC control ▪ to meet new safety regulations ▪ to improve productivity and quality

ASSESSMENT TASKS OR ACTIVITIES
• A research project on the modification of existing contactor control circuits to PLC based control applications, relay control logic circuits, final drive control components and smart sensors. • Practical exercises on the modification of contactor control circuits to PLC control, to meet new safety regulations and to improve productivity and quality

Topic 5: Maintain integrated electro-technical control systems

SUBJECT OUTCOME	
5.1 Describe and apply assembly and commissioning	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The importance of a maintenance plan, the advantages of the elements in a maintenance, assembly and commissioning plan, and the consequences of not adhering to a maintenance plan are described. • The following are explained: ▪ what is meant by EMC, and the importance thereof ▪ the impact of EMC on mechatronic components ▪ the test and procedures for EMC measurements ▪ how to reduce EMC disturbances ▪ the various shielding methods ▪ causes of over voltages and related counter measures • Devices, equipment, components and materials are prepared for assembling (transport means, hoisting gears and assembly aids are considered). • Safety measures and checks are applied and operations adjusted. • Tolerance and positions are determined. • The readiness and operation of mechanical, electrical and software components are investigated for commissioning • Errors are detected in analogue and digital circuitry. • Faulty parts are repaired and replaced, and a maintenance plan is determined. • EMC tests are performed in accordance with procedure. • Shielding methods and over voltage counter measures are applied.	• Describe ▪ the importance of the maintenance plan ▪ the advantages of the elements in a maintenance, assembly and commissioning plan. ▪ the consequences of not adhering to a maintenance plan. • Explain ▪ what is meant by EMC, and the importance thereof ▪ the impact of EMC on mechatronic components ▪ the test and procedures for EMC measurements ▪ how to reduce EMC disturbances ▪ the various shielding methods ▪ causes of over voltages and related counter measures • Prepare devices, equipment, components and materials for assembling (transport means, hoisting gears and assembly aids considered) • Apply safety measures and checks • Adjust operations • Determine tolerance and positions • Investigate the readiness and operation of mechanical, electrical and software components for commissioning • Detect error in analogue and digital circuitry • Repair and/or replace faulty parts • Determine a maintenance plan • Perform EMC tests in accordance with procedure • Apply various related shielding methods • Apply over voltage counter measures
ASSESSMENT TASKS OR ACTIVITIES	
• Class questions, case studies and an open-book test on the concepts, terminology and theory. • Practical exercises on the preparation of devices, equipment, components and materials for assembling, application of safety measures and checks, detection of errors in analogue and digital circuitry, repair and replacement of faulty parts and maintenance	

SUBJECT OUTCOME	
5.2 Apply quality control	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The impact of pollution, fatigue, wear and tear, and system reliability are explained. • Methods for checking system safety, what is meant by quality standards, various stages of quality sequences, and the time scheduling techniques for maintenance are described. • Measures to avoid production loss and product quality, system safety checking methods, quality checking sequences, and time scheduling techniques are applied.	• Explain ▪ the impact of pollution, fatigue, wear and tear ▪ system reliability • Describe ▪ methods for checking system safety ▪ what is meant by quality standards ▪ various stages of quality sequences ▪ the time scheduling techniques for maintenance • Apply ▪ measures to avoid production loss and product quality ▪ system safety checking methods ▪ quality checking sequences ▪ time scheduling techniques
ASSESSMENT TASKS OR ACTIVITIES	
• An assignment or task on the impact of pollution, fatigue, wear and tear, system reliability, checking of system safety, quality standards, quality sequences and maintenance. • Case studies on measures to avoid production loss and product quality, system safety checking methods, quality checking sequences and time scheduling techniques	

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN ELECTRO TECHNOLOGY – LEVEL 4

4.1 Integrated summative assessment task (ISAT)

A compulsory component of the external assessment (ESASS) is the **integrated summative assessment task (ISAT)**. The integrated summative assessment task draws on the student's cumulative learning achieved throughout the year. The task requires integrated application of competence and is executed and recorded in compliance with assessment conditions.

Two approaches to the integrated summative assessment task (ISAT) may be as follows:

- The students are assigned a task at the beginning of the year which they will have to complete in phases throughout the year to obtain an assessment mark. A final assessment is made at the end of the year when the task is completed.

OR

- Students achieve the competencies throughout the year but the competencies are assessed cumulatively in a single assessment or examination session at the end of the year.

The integrated summative assessment task is set by an externally appointed examiner and is conveyed to colleges in the first quarter of the year.

The integrated assessment approach enables students to be assessed in more than one subject with the same integrated summative assessment task.

4.2 National Examination

A national examination is conducted annually in October or November by means of a paper(s) set and moderated externally. The following distribution of cognitive application is suggested:

LEVEL 4	KNOWLEDGE AND COMPREHENSION	APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	30%	50%	20%

MARK ALLOCATION PER QUESTION		
Question 1:	Describe the fundamentals of three-phase machine and speed control in electrical drives.	20%
Question 2:	Design and modify three-phase electrical drive control circuits.	20%
Question 3:	Install and test electro-technical systems that employ electrical drives, switches, control gears and speed control devices.	20%
Question 4:	Modify three-phase electrical drive control technology circuits into PLC controlled applications.	20%
Question 5:	Maintain integrated electro-technical control systems	20%
	TOTAL	**100**