NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

STORED PROGRAMME SYSTEMS

NQF Level 3

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 Stored Programme Systems 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: Stored Programme Systems* to prepare for and deliver Stored Programme Systems. 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 (ICASS) 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 (ISAT).

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.

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. Use of 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 STORED PROGRAMME SYSTEMS

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 Stored Programme Systems 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

Stored Pogramme Systems, 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 Stored Programme Systems Level 3:

NUMBER OF UNITS	ASSESSMENT	COVERAGE
3	Formal written tests	One or more completed topics
1	Internal written exam	All completed topics
3	Practical assessments	The related Subject Outcomes: 2.2 Identification, selection and adjusting of distance and displacement sensors to perform function in a control application. 2.3 Identification, selection and adjusting of Force and Pressure sensors to perform function in a control application. 3.1 Identification, selection, installation and testing of correct PLC equipment elements. 4.1 A source program, a control program debugged and the design documentation. 5.1 Troubleshooting tools to perform commissioning of PLC application control programs.on electro-hydraulic hybrid control systems.

ASSESSMENT OF STORED PROGRAMME SYSTEMS

LEVEL 3

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN STORED PROGRAMME SYSTEMS – LEVEL 3

Topic 1: Describe stored programme systems used in automation control

SUBJECT OUTCOME	
1.1 Explain stored programme systems *Range: SPS types: PLC systems (automation, processing); Robotic systems; SCADA systems; Intelligent Devices (controllers, micro-processors*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• An explanation is given of ▪ what stored program systems are, ▪ the make-up and function of the various stored program devices, ▪ the applications of stored program devices and the function of a Human- Machine-Interface System such as keypad controls, monitors, displays and supervisory-control and data acquisition (SCADA) systems employed in a manufacturing system. • The differences between industrial automation and process control are described. • The purpose of the various elements that make up a stored program system is identified and explained.	• Explain ▪ what stored program systems are. ▪ the make-up and function of the various stored program devices. ▪ the applications of stored program devices. ▪ the function of a Human- Machine-Interface System such as keypad controls, monitors, displays and supervisory-control and data acquisition (SCADA) systems employed in a manufacturing system. • Describe the differences between industrial automation and process control. • Identify and explain the purpose of the various elements that make up a stored program system.
ASSESSMENT TASKS OR ACTIVITIES	
• Class questions, and a project on the theory, terms and concepts of Stored Program Systems	

SUBJECT OUTCOME	
1.2 Explain and apply PLC Technology *Range: Design elements: Input devices, processing devices and output devices (central control unit, memory, input module, output memory, programming device, software, programming languages. Fundamentals: Decimal system, binary system, BDC code, hexa-decimal, signed binary numbers, real numbers, binary and digital signal generation. Boolean operations: Basic logic functions, Further logic functions, Establishing switching functions, simplification of logic functions, Karnaugh diagrams, switching algebra systems; SCADA systems; Intelligent Devices (controllers, micro-processors)*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following concepts are listed, described and explained and drawn where indicated: ▪ the fundamental design elements of the PLC system. ▪ the purpose and function of the PLC elements. ▪ basic fundamental operations of memory elements. ▪ Boolean operations. ▪ the difference between binary, analogue and digital signals. ▪ what is meant by output devices. ▪ what is meant by signal conditioning. ▪ basic logic switching operations using switches and electro-magnetic switches. ▪ what is meant by scan rate in a PLC system. ▪ the fundamental principles of A/D and D/A convertors. • The various PLC programming languages, the various control applications employing a PLC, the various input devices, the various actuator devices and the final drive devices are listed. • The function of PLC design elements are identified, named and explained. • Fundamental number system conversions and Boolean operations are performed.	• List and describe ▪ the fundamental design elements of the PLC system. ▪ the purpose and function of the PLC elements. • Describe ▪ basic fundamental operations of memory elements. ▪ Boolean operations. • Explain ▪ the difference between binary, analogue and digital signals. ▪ what is meant by output devices ▪ what is meant by signal conditioning. ▪ and draw basic logic switching operations using switches and electro-magnetic switches. ▪ what is meant by scan rate in a PLC system. ▪ the fundamental principles of A/D and D/A convertors. • List ▪ the various PLC programming languages. ▪ the various control applications employing a PLC. ▪ the various input devices. ▪ the various actuator devices. ▪ the final drive devices. • Identify, name and explain function of PLC design

• Switching algebra is applied to solve problems.	elements. • Perform fundamental number system conversions. • Perform Boolean operations. • Apply switching algebra to solve problems.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks and rubrics on the explanation and application of PLC technology	

Topic 2: Select, apply and adjust sensor technology in industrial control applications

SUBJECT OUTCOME	
2.1 Describe Sensor Technology - Proximity Sensors *Range: Sensor types: Magnetic (contact, contactless), inductive, optical (through beam, retro-reflective, diffused), capacitive, ultrasonic. Characteristics: Switching distance, material type influences, material thickness influences, response characteristics, signal types. Applications: Speed measurement, rotational speed, work-piece assembly, liquid level measurement, checking of threads, position detection*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• An explanation of what sensors are, their importance in control applications, and the characteristics of the various sensor types is given. • Electrical symbols as used for the various proximity sensor types are named and drawn. • Various applications of the proximity sensor types, operating voltages and related control signal types are described. • Proximity sensors are identified, selected and adjusted to perform function in a control application.	• Explain ▪ what sensors are. ▪ the importance of sensors as used in control applications. ▪ the characteristics of the various sensor types. • Name and draw the electrical symbols as used for the various proximity sensor types. • Describe ▪ various applications of the proximity sensor types. ▪ the operating voltages and the related control signal types. • Identify, select and adjust proximity sensors to perform function in a control application.
ASSESSMENT TASKS OR ACTIVITIES	
• Observation sheets and an open-book test on Proximity Sensor Technology. • Practical exercises on identification, selection and adjusting of proximity sensors to perform function in a control application.	

SUBJECT OUTCOME	
2.2 Describe Sensor Technology - Distance and Displacement *Range: Sensor types: Analogue inductive sensor, linear potentiometer, ultrasonic, optical. Characteristics: Voltage measurement, range and conductivity, sound propagation, photo-electric, capacitive, response curves, signal types. Applications: Position detection, measuring by means of deflection, determine eccentricity of a rotating disc, position detection of a spindle*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• An explanation of what sensors are, their importance in control applications for distance and displacement, and the characteristics of the various sensor types is given. • The related electrical symbols as used for the various displacement and distance sensor types are named and drawn. • Various applications of the sensor types, operating voltages and the related control signal types are described. • Distance and displacement sensors are identified, selected and adjusted to perform function in a control application.	• Explain ▪ what sensors are. ▪ the importance of sensors as used in control applications for distance and displacement. ▪ the characteristics of the various sensor types. • Name and draw the related electrical symbols as used for the various displacement and distance sensor types. • Describe ▪ various applications of the sensor types. ▪ the operating voltages and the related control signal types. • Identify, select and adjust distance and displacement sensors to perform function in a control application.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks on Distance and Displacement Sensor Technology. • Practical exercises on identification, selection and adjusting of distance and displacement sensors to perform function in a control application.	

SUBJECT OUTCOME	
2.3 Describe Sensor Technology - Force and Pressure *Range*: *Sensor types: Force measurement-Strain gauges, measuring bridge amplifier, Pressure measurement-analogue pressure sensor, mechanical pressure switch, electronic pressure switch. Characteristics: Force, counter force elastic and plastic deformation, force measuring, pressure, torque, acceleration*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• An explanation of what sensors are, their importance in control applications for force and pressure, and characteristics of the various sensor types is given. • Electrical symbols as used for the various force and pressure sensor types are named and drawn. • Various applications of sensor types, operating voltages and related control signal types, and signal- and energy transmission are described. • Force and pressure sensors to perform function in a control application are identified, selected and adjusted.	• Explain ▪ what sensors are. ▪ the importance of sensors as used in control applications for force and pressure. ▪ the characteristics of the various sensor types. • Name and draw the related electrical symbols as used for the various force and pressure sensor types. • Describe ▪ various applications of the sensor types. ▪ the operating voltages and the related control signal types. ▪ signal and energy transmission. • Identify, select and adjust force and pressure sensors to perform function in a control application.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks on Force and Pressure Sensor Technology. • Practical exercises on identification, selection and adjusting of Force and Pressure sensors to perform function in a control application.	

Topic 3: Identify, select and install related PLC elements in accordance with related safety regulations

SUBJECT OUTCOME
3.1 Install a PLC system in accordance with instruction, perception drawing and wiring diagram

Range: Design procedure: Description of control task (verbal, written, perception drawing), analyse to produce installation/ process, plan the installation, draw the electrical wiring diagram, assembly of the installation PLC program, draw up a solution - functional table, logic control, sequence control system- realisation of the solution	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The procedure to determine electrical wiring diagrams and related PLC control programs are designed. • The procedure for safely installing PLC related elements is explained. • Elements that make the PLC installation safe are listed. • The correct PLC equipment elements are identified and selected to ensure PLC function is in accordance with task instruction. • PLC elements are installed in accordance with relevant safety procedures. • Installation is tested for correctness.	• Design the procedure to determine electrical wiring diagrams and related PLC control programs. • Explain the procedure for safely installing PLC related elements. • List the elements that make the PLC installation safe. • Identify and select the correct PLC equipment elements to ensure that PLC function is in accordance with task instruction. • Install PLC elements in accordance with relevant safety procedures. • Test installation for correctness.
ASSESSMENT TASKS OR ACTIVITIES	
• Class questions and an assignment on the design, explanation, and installation of PLC control programs. • Practical exercises on the identification, selection, installation and testing of correct PLC equipment elements.	

Topic 4: Create, test, debug and upload and download PLC source control programmes to an industrial system

SUBJECT OUTCOME	
4.1 Analyse the control instruction to produce a PLC control programme *Range: Control instructions: not limited to AND/NOT/OR control, branching, timer-sequence starting, conveyor belt control, counting control, sorting/checking/measuring, safety circuit). PLC terminology: configuration of a PLC, line number, operand, address, scan rate, program element, program line, debugging. Programming languages: (LD, FBD, IL, ST, SFC.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following are explained: ▪ the procedure to analyse the task control instruction. ▪ the fundamental differences between the PLC programming languages. ▪ what is meant by related PLC terminology. ▪ what is meant by simulating a program. ▪ what is meant by transferring a program. ▪ what is meant by functional check of a control system. • The documentation that would be produced when designing a control program is listed and the importance thereof explained. • The advantages and disadvantages of using a PLC are listed • Hardwired and software programming are compared. • A source program is produced in accordance with functional requirements in one LD or SL. • The control program is debugged. • The source program is simulated. • The necessary design documentation is produced.	• Explain ▪ the procedure to analyse the task control instruction. ▪ the fundamental differences between the PLC programming languages. ▪ what is meant by related PLC terminology. ▪ what is meant by simulating a program. ▪ what is meant by transferring a program. ▪ what is meant by functional check of a control system. • List ▪ the documentation that would be produced when designing a control program and explain the importance thereof. ▪ the advantages and disadvantages of using PLC. • Compare hardwired and software programming. • Produce a source program in accordance with functional requirements in one LD or SL. • Debug the control program. • Simulate the source program. • Produce the necessary design documentation.

ASSESSMENT TASKS OR ACTIVITIES
• Class questions and a class test on the concepts and terminology. • A project on documentation and the advantages and disadvantages of using a PLC. • Practical exercises and rubrics on a source program, a control program debugging and design documentation

Topic 5: Maintain and commission PLC stored programme industrial control systems

SUBJECT OUTCOME	
5.1 Commission faults in PLC systems *Range: Hardware faults: Incorrect input/output circuits; Input voltage type at input; Incorrect supply voltage or not available; No transmission between programming terminal and PLC- no interface cable; Wiring between PLC and actuators/sensors because mechanical damage to cables; Insulation stripped; Incorrect assembly/ not fastened properly. Software faults: Program created problem; Program input fault; Program transmission fault. Troubleshooting tools: Program flow charts; Sequential function chart; Function chart; Circuit diagrams with the PLC*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Possible hardware and software faults in programmable logic controllers, and the various tools used in troubleshooting programming faults are listed and explained. • Troubleshooting tools are applied to perform commissioning of PLC application control programs.	• List and explain ▪ possible hardware faults in programmable logic controllers. ▪ possible software faults in programmable logic controllers. ▪ the various tools used in troubleshooting programming faults. • Apply various troubleshooting tools to perform commissioning of PLC application control programs.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks on hardware faults and software faults. • Demonstrations and practical exercises on troubleshooting tools to perform commissioning of PLC application control programs	

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN STORED PROGRAME SYSTEMS – LEVEL 3

4.2 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 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.

4.3 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 3	KNOWLEDGE AND COMPREHENSION	APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	30%	50%	20%

MARK ALLOCATION PER QUESTION		
Section 1: Compulsory (must cover all topics)		
Question 1:	Describe stored program systems used in automation control.	15
Question 2:	Select, apply and adjust sensor technology in industrial control applications	20
Question 3:	Identify, select and install related PLC elements in accordance with related safety regulations.	20
Question 4:	Create, test, debug and up/download PLC source control programs to an industrial system.	30
Question 5:	Maintain and commission PLC stored program industrial control systems	15
	TOTAL	100%