education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

MECHATRONIC SYSTEMS

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 Mechatronic 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: Mechatronic Systems* to prepare for and deliver Mechatronic 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 MECHATRONIC 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 Mechatronic 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

Mechatronic 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 Mechatronic Systems 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	The related Subject Outcomes: 3.1 Assembly of a mechatronic system. 4.1 Performing commissioning protocols with respect to mechatronic systems. 5.1 Maintenance of mechatronic systems. 5.2 The application of quality assurance of mechatronic systems

ASSESSMENT OF MECHATRONIC SYSTEMS

LEVEL 4

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN MECHATRONIC SYSTEMS – LEVEL 4

Topic 1: Describe and analyse the mechatronic system design process

SUBJECT OUTCOME	
1.1 Explain the mechatronic system design process *Range: Design processes; Design problem and brief; Analysis and synthesis; Planning (time chart and flow chart) Research (materials, ergonomics, safety factors, research techniques (library, internet, recorded interviews, local manufacturers); Specifications; Draw up ideas; Development of best idea (safety, colour scheme, cost, spread sheets, shape, materials, mechanisms, circuit, energy, system diagrams, environment, consumer safety, control programmes, circuit diagrams, etc); Solution (working drawings, materials lists, constructional details, etc). Manufacture/ assembly planning process, flow chart, time chart, sequence drawing, make the solution execute the task, evaluation - good and bad points, effectiveness of meeting the design brief.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Design processes are listed and described. • The design problem is stated and solutions explained. • The project task is analysed (all elements to be considered). • The functions of time charts and flow charts are described. • Various research techniques and their importance are described. • The importance of specifications, the purpose of drawing up ideas, how to develop an idea, the purpose of developing related drawings and lists for a solution, and why task evaluation is necessary, are explained. • A design problem is interpreted and a brief designed. • Problem solving is explained.	• List and describe the design processes • State the design problem and explain how it should be solved • Analyse the project task (all elements to be considered) • Describe the functions of time charts and flow charts • Describe the various research techniques and their importance • Explain ▪ the importance of specifications ▪ the purpose of drawing up ideas ▪ how a best idea would be developed ▪ the purpose of developing related drawings, lists, etc for a solution ▪ why it is necessary to evaluate the task • Interpret a design problem and design a brief • Explain how you would solve the problem
ASSESSMENT TASKS OR ACTIVITIES	
An assignment, demonstrations and an open-book test on the mechatronic system design process	

Topic 2: Design a mechatronic system

SUBJECT OUTCOME	
2.1 Design a mechatronic system task solution *Range: Design processes; Design problem and brief; Analysis and synthesis; Planning; Specifications; Draw up ideas; Development of best idea; Documented solution.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The importance of a budget, and the reasons for economic considerations are explained • The reason for control of the project with respect to time frames, and what is meant by the term “brain storming” when creating ideas are explained • Related questions are listed and answered • All aspects of the process, and time management considerations are planned • Research is performed • The project and sub section specifications are drawn up • Six closely related ideas are drawn up to solve the project task • The best idea is developed • Relevant diagrams for the solution are produced	• Explain ▪ the importance of the budget ▪ the reasons for economic considerations ▪ the reason for control of the project with respect to time frames ▪ what is meant by the term “brain storming” when creating ideas • List as many related questions as possible • Answer the questions asked in the analysis • Plan all aspects of the process and time management considerations • Perform research • Draw up the project and sub section specifications • Draw up approximately six closely related ideas to solve the project task • Develop the best idea • Produce the relevant diagrams for the solution

ASSESSMENT TASKS OR ACTIVITIES
A project and rubrics on the design of a mechatronic system

Topic 3: Assemble a mechatronic system

SUBJECT OUTCOME	
3.1 Describe and perform assembling of a mechatronic system *Range: Manufacture/ assembly (planning process, flow chart, time chart, sequence drawing); Find the solution; Execute the task*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The importance of the sequence diagram and how it is developed are described • The importance of execution planning is described • The purpose of flow charts in process and programming applications is explained • The necessity of producing an evaluation check list is explained • Circuit and sequence diagrams are interpreted • The design task solution is executed • Components are installed and connected • Hardware and software are integrated and interfaced • Programming functions are performed	• Describe ▪ the importance of the sequence diagram and how it is developed ▪ the importance of planning the execution • Explain ▪ the purpose of flow charts in process and programming applications ▪ why it is necessary to produce an evaluation check list • Interpret related circuit and sequence diagrams • Execute the design task solution • Install components • Connect components • Integrate hardware and software • Interface the hardware and software • Perform programming functions
ASSESSMENT TASKS OR ACTIVITIES	
• An assignment of tasks on the process of and the assembly of a mechatronic system. • Practical exercises on assembly of a mechatronic system	

Topic 4: Commission a mechatronic system

SUBJECT OUTCOME	
4.1 Perform commissioning protocols with respect to mechatronic systems *Range: Evaluation of good and bad points; Has the design brief been answered?*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The necessity for performing adjustments to various control elements is described • The necessity for performing function tests is described • The importance of producing a commissioning check list is explained • Commissioning protocols are explained • All relevant safety measures are considered • Correct energy specifications are met • Sensor units are calibrated • Relevant drive components are tuned and control units adjusted • Errors and disturbances are investigated • Programming is debugged • Hardware and software tests are performed • Failures to the design, work scheduling production and assembly are corrected • Function operational tests are performed	• Explain ▪ and discuss why it is necessary to perform adjustments to various control elements ▪ why it is necessary to perform function tests ▪ the importance of producing a commissioning check list ▪ what the commissioning protocols are • Ensure that all relevant safety measures are considered • Ensure that correct energy specifications are met • Calibrate sensor units • Tune relevant drive components • Adjust control units • Investigate errors and disturbances • Debug programming if necessary • Perform hardware and software tests • Correct failure to the design, work scheduling production and/or assembly • Perform function operational tests
ASSESSMENT TASKS OR ACTIVITIES	
• Demonstrations, practical exercises and rubrics on performing commissioning protocols with respect to mechatronic systems	

Topic 5: Maintain and apply quality assurance to a mechatronic system

SUBJECT OUTCOME	
5.1 Maintain mechatronic systems *Range: Diagnostic tools (hydraulic, pneumatic, electrical and control equipment programs); Fault tree analysis; Demand analysis (schematic sketches, flowcharts, function charts).*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Various testing and measurement methods are described • The meaning of preventive maintenance is explained • The terms *error analysis, error correction* and *fault clearance* are defined • The tools that can be used to assist in the maintenance of mechatronic systems are described • Troubleshooting and debugging procedures and their use are explained • Maintenance planning, diagnostic procedures and system maintenance are described • Mechatronic systems are inspected, and function of safety equipment checked, and inspections documented • Mechatronic systems are maintained in accordance with maintenance and repair plans • Worn parts are exchanged as part of preventative maintenance • Malfunctions are removed by reworking or exchange of parts • Software malfunctions are removed • System parameters are compared with pre-set values and adjusted accordingly • Mechatronic systems are repaired by adhering to operational processes • Mechatronic systems are adjusted to changing operational conditions • Diagnostic and maintenance systems and procedures are used	• Describe various testing and measurement methods • Explain what is meant by preventive maintenance • Define what is meant by the following terms: *error analysis*, *error correction* and *fault clearance* • Describe ▪ the various tools that can be used to assist in the maintenance of mechatronic systems ▪ what and how troubleshooting and debugging procedures are used ▪ maintenance planning, diagnostic procedures and how systems are maintained • Inspect mechatronic systems, check function of safety equipment, and document inspections • Maintain mechatronic systems in accordance with maintenance and repair plans • Exchange worn parts in the framework of preventative maintenance • Remove malfunctions by reworking or exchange of parts • Remove software malfunctions • Compare system parameters with pre-set values and adjust accordingly • Repair mechatronic systems by adhering to operational processes • Adjust mechatronic systems to changing operational conditions • Make use of diagnostic and maintenance systems and procedures
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks on terminology and concepts. • Practical exercises on maintenance of mechatronic systems	

SUBJECT OUTCOME	
5.2 Apply quality assurance of mechatronic systems *Range: ISO 9000 – 9004 (quality assurance methods, quality planning, quality checks, quality control).*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• What a technical manual is and its purpose are explained. • The importance of standards and specifications are explained with respect to safety quality • The effects of pollution, fatigue, wear and tear on quality are explained • The effects of system reliability on quality are explained. • Quality Standards referenced by ISO 9000-9004 are described. • Quality management and its efficiency are assessed in relation to technical manuals and application procedures. • Safety is applied whilst working. • Specification standards are ensured and adhered to whilst working. • Document malfunctions and quality flaws are found and remedied. • Continuous improvement of work processes is implemented in one's own field of work. • The ways in which quality defects are eliminated are documented.	• Explain ▪ what a technical manual is and its purpose ▪ the importance of standards and specifications with respect to safety quality ▪ the effects of pollution, fatigue, wear and tear on quality ▪ the effects of system reliability on quality • Describe Quality Standards referenced by ISO 9000-9004 • Assess quality management and its efficiency in relation to technical manuals and apply procedures • Apply relevant safety whilst working • Ensure that specification standards are adhered to whilst working • Find and remedy document malfunctions and quality flaws • Contribute to a continuous improvement of work processes in one's own field of work • Document how quality defects are eliminated
ASSESSMENT TASKS OR ACTIVITIES	
• Observation • Case studies, practical exercises and checklists on the application of quality assurance of mechatronic systems	

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN MECHATRONIC SYSTEMS – 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 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		
Section 1: Compulsory (must cover all topics)		
Question 1:	Describe and analyse the mechatronic system design process	10%
Question 2:	Design a mechatronic system	25%
Question 3:	Assemble a mechatronic system	30%
Question 4:	Commission a mechatronic system	15%
Question 5:	Maintain and apply quality assurance to a mechatronic system	20%
	TOTAL	100