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NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

APPLIED ENGINEERING TECHNOLOGY NQF Level 4

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APPLIED ENGINEERING TECHNOLOGY – LEVEL 4

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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 Engineering Systems, Engineering Graphics and Design (CAD) and Applied Engineering 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: Applied Engineering Technology* to prepare for and deliver Applied Engineering Technology (Level 4). 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 students' work with other students, 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 or a 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 students' 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 (ISAT) 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 assessor; 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 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 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	<ul style="list-style-type: none"> • Observation • Class questions • Lecturer, student, parent discussions 	<ul style="list-style-type: none"> • Assignments or tasks • Projects • Investigations or research • Case studies • Practical exercises • Demonstrations • Role-play • Interviews 	<ul style="list-style-type: none"> • Examinations • Class tests • Practical examinations • Oral tests • Open-book tests
Assessment tools	<ul style="list-style-type: none"> • Observation sheets • Lecturer's notes • Comments 	<ul style="list-style-type: none"> • Checklists • Rating scales • Rubrics 	<ul style="list-style-type: none"> • Marks (e.g. %) • Rating scales (1-7)
Evidence	<ul style="list-style-type: none"> • Focus on individual students • Subjective evidence based on lecturer observations and impressions 	<p>Open middle: Students produce the same evidence but in different ways.</p> <p>Open end: Students use same process to achieve different results.</p>	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 7) 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 is a different way of assessing and 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 what criteria they are evaluated. Space for comments is essential.

SECTION C: ASSESSMENT IN APPLIED ENGINEERING 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 PoE account for the other 50 percent.

The PoE and the external assessment include practical and written components. The practical assessment in Applied Engineering 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

Applied Engineering 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 PoE 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 PoE, its exact location must be recorded and it must be readily available for moderation purposes.

ASSESSMENT OF APPLIED ENGINEERING TECHNOLOGY LEVEL 4

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN APPLIED ENGINEERING TECHNOLOGY - LEVEL 4

Topic 1: Mechanical fundamentals of the engineering industry

SUBJECT OUTCOME	
1.1 Explain the principles of mechanical engineering	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The principles of motion in mechanical engineering are explained, and its relevance to friction and resistance in mechanical components. 	<ul style="list-style-type: none"> Explain motion in engineering design. <i>Range: Resistance to motion, friction as a result of motion, inertia property of an object, Newton's third law of motion.</i>
<ul style="list-style-type: none"> Surface finishes involving sliding motion are evaluated and alternatives are considered in order to reduce friction. 	<ul style="list-style-type: none"> Evaluate surface finishes involving sliding motion and consider alternatives to reduce friction.
<ul style="list-style-type: none"> The mass of matter is considered with reference to its direct relationship to friction and the force required for motion. 	<ul style="list-style-type: none"> Consider the mass of matter with reference to its direct relationship to friction and the force required for motion.
<ul style="list-style-type: none"> The inertia effect is explained as a result of mass and its resistance to motion resulting in the force required. <i>Range: Mechanical processes may include but are not limited to centrifugal separation, polarisation, motorised conveying.</i> 	<ul style="list-style-type: none"> Explain the inertia effect as a result of mass and its resistance to motion resulting in the force required. <i>Range: Mechanical processes may include but are not limited to centrifugal separation, polarisation, motorised conveying.</i>
ASSESSMENT TASKS OR ACTIVITIES	
Demonstrations, illustrations, group discussions, sketches and written tests.	

SUBJECT OUTCOME	
1.2 Explain the operating principles of mechanical components used in the engineering related design industry.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The operating principles of bearings are explained in terms of their means of reducing friction and for accommodating axial and radial loads and speed requirements. 	<ul style="list-style-type: none"> Identify and describe the use of plain bearings. <i>Range: Thick film lubricant, thin film lubricant, zero lubricant.</i> Identify and describe the use of roller bearings. <i>Range: Ball bearing, roller bearing, tapered roller bearing, cylindrical roller bearing, radial thrust bearing, angular thrust bearing, self aligning bearing, needle roller bearing.</i>
<ul style="list-style-type: none"> The operating principles of pumps are explained in terms of their means of pumping, their delivery head characteristics and typical applications. 	<ul style="list-style-type: none"> Identify and explain the working and the use the five general classifications in pump technology. <i>Range: Reciprocating pump, steam pump, rotary pump, pistonless pumps, centrifugal pump, liquid ring.</i> Explaining the following terminology related to pump technology. <i>Range: Pressure: negative pressure, positive pressure Heads: suction, static, delivery, pressure.</i>

ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The operating principles of valves are explained in terms of their shut-off and flow characteristics and their operating limitations. The operating principles of pneumatic linear and rotary stem motion valve actuators are explained in terms of their mode of operation and configuration for fail-safe operation, operating limitations and typical applications. 	<ul style="list-style-type: none"> Describe and explain the use of hydraulic and pneumatic valves. <i>Range: Hydraulic, Pneumatic, Relief valve, Throttle / regulation valve, spool/4 way valve, rotary valve, diversion valve, non return valves.</i>
<ul style="list-style-type: none"> The operating principles of drive transmissions are explained in terms of their means of transmitting power and motion, reducing friction and their typical applications. 	<ul style="list-style-type: none"> Describe the reasons for the use of different driving transmissions. <i>Range: V belts, flat belts, chain drives, gear drives, frictional drive.</i>
<ul style="list-style-type: none"> The operating principles of couplings are explained by means of sketches. 	<ul style="list-style-type: none"> Describe and explain the use of couplings. <i>Range: Flexible couplings, marine type coupling, fenner-flex couplings, hydraulic couplings, self-aligning couplings, flange coupling, bibby coupling, single-plate clutch coupling, multi- plate-clutch coupling.</i>
<ul style="list-style-type: none"> The operating principles of seals are explained in terms of their means of sealing, reducing friction and their typical applications. 	<ul style="list-style-type: none"> Describe and explain the use of seals. <i>Range: Packing, labyrinth, carbon ring , contact seals, oil seals, o-ring.</i>
<ul style="list-style-type: none"> The operating principles of a typical refrigeration system are explained in terms of the refrigerant cycle of compression, liquefaction and evaporation. 	<ul style="list-style-type: none"> Explain the refrigeration cycle. <i>Range: Liquefaction, vapour, heat exchange, high and low pressure of liquid, high and low pressure of vapour.</i> Explain the operation of a domestic refrigerator <i>Range: Convection flow of air, type of gas, temperature control, expansion valve, relay, overload.</i>
ASSESSMENT TASKS OR ACTIVITIES	
Demonstrations, illustrations, group discussions, sketches and written tests.	

SUBJECT OUTCOME	
1.3 Explain and perform safety checks on mechanical equipment.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> Safe operating procedures for mechanical equipment are explained in terms of operating within design load and operating conditions, and things an operator can check for to help achieve design life. 	<ul style="list-style-type: none"> Describe safety procedures involved during the usage of mechanical equipment.
<ul style="list-style-type: none"> Safe operating procedures for mechanical equipment are explained in terms of generally accepted guidelines for prevention of damage or deterioration to product. 	<ul style="list-style-type: none"> Carry out a diagnostic analysis on mechanical equipment and report the findings. <i>Range: Amperage, vibration, noise, excess play, oil leakage, rust deposits.</i>
ASSESSMENT TASKS OR ACTIVITIES	
Practical demonstration, illustrations, group discussions, sketches and written tests.	

SUBJECT OUTCOME	
1.4 Ensure safety in work practices when working in the vicinity of mechanical equipment.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The applicable safety rules and standards in the vicinity of mechanical equipment are implemented and adhered to. 	<ul style="list-style-type: none"> Demarcate the location of machines and walk ways.
	<ul style="list-style-type: none"> Provide pallets for component handling.
	<ul style="list-style-type: none"> Ensure the height of working tables conforms to industry safety standards.
	<ul style="list-style-type: none"> Ensure that warning and informative signs are appropriately positioned.
	<ul style="list-style-type: none"> Safety attire conforms to workplace requirements.
	<ul style="list-style-type: none"> Provide adequate working space, illumination and ventilation in the work area.
	<ul style="list-style-type: none"> Ensure that safety instructions are always obeyed and adhered to.
	<ul style="list-style-type: none"> Ensure pre-operational inspection of applicable equipment is performed.
	<ul style="list-style-type: none"> Ensure spillage on working surfaces is immediately attended to.
ASSESSMENT TASKS OR ACTIVITIES	
Practical demonstration, illustrations, group discussions, sketches and written tests	

Topic 2: Engineering practices are used to construct a structure prototype capable of bearing a point and/or distributed load

SUBJECT OUTCOME	
2.1 Interpret, draw and make calculations of a minimally engineered, supported structure capable of bearing a point and/or distributed load.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The difference between point loading and distributed loading are explained with sketches. A point load is described in terms of its effects on a simply supported structure. 	<ul style="list-style-type: none"> Explain with sketches the difference between point loading and distributed loading.
<ul style="list-style-type: none"> Forces acting in the members of a simply supported structure are calculated and described in terms of their effects on the structure 	<ul style="list-style-type: none"> Explain with examples beam loading, identifying the different fields/methods of application.
<ul style="list-style-type: none"> The bending moment and shear force diagrams of the Identified structures are drawn 	<ul style="list-style-type: none"> Perform calculations of bending moments and shear forces applicable to the design.
ASSESSMENT TASKS OR ACTIVITIES	
Written tests, illustrations, group discussions and drawings.	

SUBJECT OUTCOME	
2.2 Design and construct a prototype of a structure for a given design problem.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> Design of a prototype includes material/s and construction processes to take account of minimal engineering practices. 	<ul style="list-style-type: none"> Apply calculations and their representation in the prototype design Design prototype with new and different technological impact, considering a range of factors: <i>Range: Design purpose, abnormal environmental issues, minimal material in construction, architectural appeal.</i>
<ul style="list-style-type: none"> Construction of the prototype solves the design problem and takes account of its design process. 	<ul style="list-style-type: none"> Interpret the prototype, its constructional design and relevancy to the point of application.
ASSESSMENT TASKS OR ACTIVITIES	
Practical project.	

SUBJECT OUTCOME	
2.3 Test and evaluate the prototype and make any necessary modifications	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The prototype is tested and evaluated against the given specifications of the design problem, and modifications are identified, where necessary. 	<ul style="list-style-type: none"> Accommodate environmental conditions relevant to design Identify and analyse design faults where they exist
<ul style="list-style-type: none"> The prototype, with any necessary modifications made, is justified in terms of the design problem 	<ul style="list-style-type: none"> Apply corrective measures where appropriate <i>Range: Financial constraints, consumer pressure, political implications, professionalism.</i>
ASSESSMENT TASKS OR ACTIVITIES	
Practical project.	

Topic 3: Functionally dependant mechanisms are incorporated into a prototype of a technological solution

SUBJECT OUTCOME	
3.1 Describe functionally dependant mechanisms.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> Functionally dependent mechanisms are identified and explained in terms of their component mechanisms and functional relationships. 	<ul style="list-style-type: none"> Explain the dependency of components that are linked in order to produce motion <i>Range: Mechanical, hydraulic, pneumatic, electrical.</i>
<ul style="list-style-type: none"> Functionally dependent mechanisms are explained in terms of their specific performance abilities and constraints. 	<ul style="list-style-type: none"> Describe examples of dependency to produce a proto type. <i>Range: Motor vehicle (body, engine, gearbox, differential, wheels, electrical links), electrical motor (case, status, stator, armature, commutator, brushes).</i>
ASSESSMENT TASKS OR ACTIVITIES	
Written tests, illustrations, group discussions, drawings and demonstrations.	

SUBJECT OUTCOME	
3.2 Design and construct a prototype to solve a given design problem.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> • Specific performance requirements are identified for the design problem. 	<ul style="list-style-type: none"> • Apply new design concepts onto an illustrative plan.
<ul style="list-style-type: none"> • Design of the prototype includes material/s and construction process to enable appropriate functioning of the mechanisms. 	<ul style="list-style-type: none"> • Interpret illustrations and create a new prototype design. • Examine the prototype for comparisons of previous design faults.
<ul style="list-style-type: none"> • Construction of the prototype solves the design problem and is in accordance with the design process. 	<ul style="list-style-type: none"> • Check all specifications, their corrections and identify them in the prototype upgrade.
ASSESSMENT TASKS OR ACTIVITIES	
Practical project.	

SUBJECT OUTCOME	
3.3 Test and evaluate the prototype and make any necessary modifications.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> • The prototype is tested and evaluated against the given specifications of the design problem, and modifications are identified, where necessary. 	<ul style="list-style-type: none"> • Assimilate operating conditions for prototype, recording test results. • Field test prototype for operational expectations.
<ul style="list-style-type: none"> • The prototype, with any necessary modifications made, is justified in terms of the design problem. 	<ul style="list-style-type: none"> • Check prototype against design specifications and analyse results.
ASSESSMENT TASKS OR ACTIVITIES	
Test and evaluate the prototype	

Topic 4: Control system is incorporated into a prototype of a technological solution

SUBJECT OUTCOME	
4.1 Explain and sketch different control systems.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> • Control systems are described using diagrams to show the structure and components of the systems. 	<ul style="list-style-type: none"> • Illustrate diagrammatically the different control systems. <i>Range: Mechanical, hydraulic, pneumatic, at least two control systems that have at least two inputs, two output states, and a feedback path.</i>
<ul style="list-style-type: none"> • Control systems are explained in terms of their component interactions, form/s of control employed, and construction details. 	<ul style="list-style-type: none"> • Explain control systems in terms of their component interactions, form/s of control employed, and construction details.
<ul style="list-style-type: none"> • Components are described in terms of requirements for the operation of the control systems. 	<ul style="list-style-type: none"> • Describe components in terms of requirements for the operation of the control systems.
<ul style="list-style-type: none"> • The control system is identified and described diagrammatically. 	<ul style="list-style-type: none"> • Identify and describe the control system diagrammatically.
ASSESSMENT TASKS OR ACTIVITIES	
Drawings, illustrations, written tests sketches	

SUBJECT OUTCOME	
4.2 Construct a control system to solve a given design problem.	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The causes of the problem are identified. <i>Range: Operator, electrical, mechanical or environmental conditions/effect.</i> 	<ul style="list-style-type: none"> Identify the causes of the problem. <i>Range: Operator, electrical, mechanical or environmental conditions or effects.</i>
<ul style="list-style-type: none"> The diagram to construct a control system is used. 	<ul style="list-style-type: none"> Use the diagram to construct a control system
<ul style="list-style-type: none"> The form of a control system is selected and components used against the requirements of the design problem are justified. 	<ul style="list-style-type: none"> Select the form of a control system and justify components used against the requirements of the design problem
<ul style="list-style-type: none"> Design of the prototype includes the control system components and structure, material/s, and construction process. 	<ul style="list-style-type: none"> Include the control system components and structure, material/s, and construction process in the design of the prototype.
ASSESSMENT TASKS OR ACTIVITIES	
Construct a control system for the prototype to solve a problem.	

SUBJECT OUTCOME	
4.3. Test and evaluate the prototype and make any necessary modifications	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The impact to maintenance and down time of system is considered. 	<ul style="list-style-type: none"> Consider the impact to maintenance and down time of system.
<ul style="list-style-type: none"> The skill of operation required is considered. 	<ul style="list-style-type: none"> Consider the skill of operation required.
<ul style="list-style-type: none"> Efficiency of system is analysed and whether it meets its operational expectancy. 	<ul style="list-style-type: none"> Analyse efficiency of system and whether it meets its operational expectancy
<ul style="list-style-type: none"> Modification is evaluated and the results are recorded. 	<ul style="list-style-type: none"> Evaluate modification and record the results
<ul style="list-style-type: none"> Further modifications are made where necessary, taking into account circumstantial considerations. <i>Range: Specific time, skills availability, replacement of parts onsite, time for modification, testing and reversal of the situation.</i> 	<ul style="list-style-type: none"> Make further modification where necessary, taking into account circumstantial considerations. <i>Range: Specific time, skills availability, replacement of parts onsite, time for modification, testing and reversal of the situation.</i>
ASSESSMENT TASKS OR ACTIVITIES	
Test and evaluate prototype together with the control system.	

SUBJECT OUTCOME	
4.4 Apply the prototype according to organisational requirements	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> The responsibilities of a process operator working with mechanical equipment are identified in accordance with organisational requirements. 	<ul style="list-style-type: none"> Identify the responsibilities of a process operator working with mechanical equipment in accordance with organisational requirements.
<ul style="list-style-type: none"> Safe work practices for working with mechanical equipment in accordance with organisational requirements are demonstrated. 	<ul style="list-style-type: none"> Demonstrate safe working practices for working with mechanical equipment in accordance with organisational requirements.
ASSESSMENT TASKS OR ACTIVITIES	
Demonstrate safe work practices.	

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN APPLIED ENGINEERING 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 (ISAT) 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 during 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 during 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 (ISAT) 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 (ISAT).

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
	40%	50%	10%