NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

MANUAL MANUFACTURING

NQF Level 2

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 Manual Manufacturing 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: Manual Manufacturing* to prepare for and deliver Manual Manufacturing. 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 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 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 is not a qualified educator or has not been declared a competent assessor, an assessor who has been declared competent may be appointed to oversee the assessment process to ensure the quality and integrity of assessments.

6 TYPES OF ASSESSMENT

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

6.1 Baseline assessment

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

6.2 Diagnostic assessment

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

6.3 Formative assessment

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

6.4 Summative assessment

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

7 PLANNING ASSESSMENT

An assessment plan should cover three main processes:

7.1 Collecting evidence

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

7.2 Recording

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

7.3 Reporting

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

8 METHODS OF ASSESSMENT

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

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

9 INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE

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

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

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

10 TOOLS FOR ASSESSING STUDENT PERFORMANCE

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

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

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

11 SELECTING AND/OR DESIGNING RECORDING AND REPORTING SYSTEMS

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

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

12 COMPETENCE DESCRIPTIONS

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

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

13 STRATEGIES FOR COLLECTING EVIDENCE

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

13.1 Record sheets

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

13.2 Checklists

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

SECTION C: ASSESSMENT IN MANUAL MANUFACTURING

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 Manual Manufacturing 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

Manual Manufacturing, 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 Manual Manufacturing - Level 2:

NUMBER OF UNITS	ASSESSMENT	COVERAGE
3	Formal written tests	One or more completed topics
1	Internal written exam	All completed topics
3	Practical assessments	• 1.1 Behaviour in case of accidents, first aid procedures, fire prevention measures, preventative measures whilst working with tools, equipment and machinery. • 2.1 Work-pieces drawn in Perception, Free-hand and Projection views. • 2.2 Working drawings. • 3.2 Cutting and forming. • 3.3 Connections, parts, lubricating and cooling devices, pipes and tubing. • 4.1 Joining of metals by means of welding. • 4.2 Joining of metals by means of soldering.

ASSESSMENT OF MANUAL MANUFACTURING

LEVEL 2

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN MANUAL MANUFACTURING–LEVEL 2

Topic 1: Identify and apply safety and health care during work.

<table>
<tr><th colspan="2">SUBJECT OUTCOME</th></tr>
<tr><td colspan="2">1.1 Identify and apply safety- and health care during work.
Range: NOSA, Occupational Health and Safety Act and Safety-, Health- and Environment programmes. General safety in workplace and responsibility thereof, elevated positions, grinding, drilling, machining, maintenance on electrical equipment.</td></tr>
<tr><th>ASSESSMENT STANDARDS</th><th>LEARNING OUTCOMES</th></tr>
<tr><td>• The following are explained:
▪ why safety is important.
▪ what safety precautions to take under various working conditions.
• The following are described:
▪ basic first aid procedures for various related common accidents.
▪ basic procedures for fire fighting.
▪ the purpose of the Occupational, Health and Safety (SHE) Act.
▪ the SHE related worksite programme.
▪ NOSA- and related gradings in factories/workshops.
▪ various related safety equipment used in the manufacturing processes.
• Safety and health hazards are identified in the work place and preventative measures initiated.
• Work place related safety regulations and procedures are adhered to.
• Appropriate actions in case of accidents are described and demonstrated and first aid procedures initiated.
• Fire prevention measures are applied whilst working.
• Preventative measures are applied whilst working with tools, equipment and machinery.
• Work is done safely with consideration for self and others.
• Hand tools are inspected, used and cared for in the prescribed manner.
• An accident report is produced.
• Safety equipment is used while working.</td><td>• Explain
▪ why safety is important
▪ what safety precautions to take under various working conditions
▪ and describe the basic first aid procedures for various related common accidents
▪ and describe the basic procedures for fire fighting
▪ and describe the purpose of the Occupational, Health and Safety (SHE) Act
▪ and describe the SHE related worksite programme
▪ NOSA and related gradings in factories/workshops
▪ various related safety equipment used in manufacturing processes.
• Identify safety and health hazards in the work place and initiate preventative measures.
• Adhere to work place related safety regulations and procedures.
• Describe and demonstrate appropriate actions in the case of accidents and initiate first aid procedures.
• Apply fire prevention measures whilst working.
• Apply preventative measures whilst working with tools, equipment and machinery.
• Work safely with consideration for self and others.
• Inspect, use and care for hand tools in the prescribed manner.
• Produce an accident report.
• Use safety equipment while working.</td></tr>
<tr><th colspan="2">ASSESSMENT TASKS OR ACTIVITIES</th></tr>
<tr><td colspan="2">• Case studies and practical exercises related to behaviour in case of accidents, first aid procedures, fire prevention measures, preventative measures whilst working with tools, equipment and machinery.
• Demonstrations and role-play related to hand tools inspection, uses and care, accident reports and safety equipment.
• Oral tests and an open-book test on the terms and theoretical concepts.</td></tr>
</table>

SUBJECT OUTCOME	
1.2 Describe and apply environment protection at work.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Environmental hazards caused by industry, contributions that industry should make to environmental protection, and the prevention of environmental hazards in the area of work are described. • Environmental protection regulations that companies must adhere to are listed. • Regulations for the protection of the environment are adhered to. • Economic and environmentally-friendly uses of energy and materials are implemented. • Wastage is prevented and materials and substances recycled in an environmentally-friendly way.	• Describe ▪ possible environmental hazards caused by industry. ▪ contributions that industry should make to environmental protection and reasons for these. ▪ contributions towards the prevention of environmental hazards in the area of work. • List environmental protection regulations that companies must adhere to. • Adhere to regulations for the protection of the environment. • Make use of possibilities of economic and environmental-friendly uses of energy and materials. • Prevent wastage, recycle materials and substances in an environmentally-friendly way.
ASSESSMENT TASKS OR ACTIVITIES	
• A project and rubrics on the application of environment protection at work.	

Topic 2: Read, interpret, produce and apply engineering drawings to the manufacture of mechatronic sub-systems.

SUBJECT OUTCOME	
2.1 Read and interpret working drawings. *Range: Perception, freehand, component, sub-assembly and general assembly drawing.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The reason and purpose of engineering drawings is explained. • The following theoretical concepts are explained and applied: ▪ drawing types, lines and lettering standards ▪ representation of plane, straight-line limited work pieces ▪ fundamentals of dimensioning ▪ dimensioning in accordance to a reference plane ▪ dimensioning of symmetrical work-pieces ▪ dimensioning of angles and slanted edges ▪ the use and importance of material lists ▪ plane work-pieces rounded with circles and boreholes ▪ circle construction ▪ bisecting to establish a vertical centre line ▪ bisecting an angle ▪ determination of circle mid-point ▪ construction of a regular hexagon ▪ connecting circles and straight line ▪ dimensioning of circles and radii. • Work-pieces drawn in perception, free-hand and projection views (prismatic, cylindrical and sectional) are explained and applied. • Engineering drawings are read and interpreted for marking off purposes, manufacturing purposes and assembly purposes.	• Explain the reason and purpose of engineering drawings. • Explain and apply: ▪ drawing types, lines and lettering standards ▪ representation of plane, straight-line limited work pieces ▪ fundamentals of dimensioning ▪ dimensioning in accordance to a reference plane ▪ dimensioning of symmetrical work-pieces ▪ dimensioning of angles and slanted edges ▪ the use and importance of material lists ▪ plane work-pieces rounded with circles and boreholes ▪ circle construction ▪ bisecting to establish a vertical centre line ▪ bisecting an angle ▪ determination of circle mid-point ▪ construction of a regular hexagon ▪ connecting circles and straight line ▪ dimensioning of circles and radii. • Explain and apply work-pieces drawn in various views (prismatic, cylindrical and sectional): ▪ Perception ▪ Free-hand ▪ Projection • Read and interpret engineering drawings for marking off purposes, manufacturing purposes and assembly purposes.

ASSESSMENT TASKS OR ACTIVITIES
• Assignments or tasks on the theoretical concepts. • Practical exercises on work-pieces drawn in perception, free-hand and projection views. • A class test on engineering drawings.

SUBJECT OUTCOME	
2.2 Produce and apply a working drawing *Range: Perception, freehand, component, sub-assembly and general assembly drawing.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The purpose and application of drawing apparatus, drawing paper sizes, measurements and scales, graphical representation of information and CAD systems and principles are explained. • Standard parts and mechanical connections such as outer/inner thread and dimensioning rules, screw nuts and washers, screw connection related to assembly drawings and rivet connections are explained. • Quality working drawings are produced at an acceptable standard.	• Explain ▪ the purpose and application of drawing apparatus ▪ drawing paper sizes, measurements and scales ▪ graphical representation of information ▪ CAD systems and principles. • Explain standard parts and mechanical connections: ▪ Outer/inner thread and dimensioning rules ▪ Screw nuts and washers ▪ Screw connection related to assembly drawings ▪ Rivet connections • Produce quality working drawings at an acceptable standard.
ASSESSMENT TASKS OR ACTIVITIES	
• An assignment or task on the purpose and application of drawing apparatus, drawing paper sizes, measurements and scales, graphical representation of information and CAD systems and principles • A project on standard parts and mechanical connections • Practical exercises on working drawings.	

Topic 3: Identify, select, use and care for safety equipment, hand tools and power tools in the manufacture of mechatronic sub-systems.

SUBJECT OUTCOME	
3.1 Describe, measure, mark and check mechatronic sub-system tools. *Range: Rulers, vernier callipers, scribers, centre-punches, micrometers, vernier height gauges, feeler gauges, thread gauges, angle gauges, dividers, engineers' squares, surface gauges, measuring tapes and protractors (digital and conventional types).*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Terminology such as measurement, dimension, radii and angle is explained and the manner in which they are read from measuring, marking and checking tools. • The manner of caring for different measuring, marking and checking tools is explained. • Reference and datum lines are explained and applied. • Various air-gap checking techniques are explained. • Different measuring, marking and checking tools are identified and their use explained. • Measuring equipment is identified, selected and used for testing and measurement of lengths, angles and surfaces. • Lengths are measured with rulers and vernier callipers to check adherence to tolerances and fits. • The light gap method is used to check surfaces for smoothness, angle and form, and surface finish visually checked according to machine symbols and drawing instructions. • Work pieces are scribed, centre punched and marked off in consideration of material characteristics. • Angles are measured and marked with a protractor	• Explain ▪ terminology: measurement, dimension, radii, angle, and explain how they are read from measuring, marking and checking tools ▪ how to care for different measuring, marking and checking tools ▪ and apply reference and datum lines ▪ various air-gap checking techniques. • Identify ▪ different measuring, marking and checking tools and explain how to use them ▪ select and use measuring equipment for testing and measurement of lengths, angles and surfaces. • Measure lengths with rulers and vernier callipers to check adherence to tolerances and fits. • Use the light gap method to check surfaces for smoothness, angle and form, visually check surface finish in accordance with machine symbols and drawing instructions. • Scribe, centre punch and mark off work pieces with consideration for material characteristics. • Measure and mark angles with a protractor and check

and checked with an angle gauge.	with an angle gauge.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks related to the theory and terminology. • Practical exercises using measuring equipment.	

SUBJECT OUTCOME	
3.2 Describe and perform cutting and forming. *Range: Hammers, files, hacksaws, chisels, hole-punches, hand taps and tap wrenches, stocks and dies, reamers, sheet metal cutters, clamping devices, drill bits, drilling machines (hand held/power fixed/manual), related cutting fluids, grindstones and grinding machines.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Hand tools and parts of a drilling machine and a grinding machine are named and identified. • The following theory is explained: ▪ how to care for cutting- and forming tools. ▪ how to use cutting and forming tools. ▪ various processes that are used when cutting and forming. ▪ various thread types. ▪ the purpose of work holding and how it is done. ▪ the various aspects of safety when using chip making machinery. ▪ what is meant by the following terms: chip making processes, friction, speed/strokes per second, revolutions per second, grinding, reaming, drilling, cutting, forming, filing, tapping. • Plastic and metal sheets, plates and profiles are sawed as prescribed. • Surfaces are filed and deburred and work pieces are shaped flat, square, parallel and angled to a measure and accuracy of +/- 2mm and to a surface finish of Rz of between 6.3 and 40µm. • Holes are drilled to a location tolerance of +/- 0.2mm by drilling, enlarging and profile countersinking and reaming, drilling holes to an accuracy as per IT7 and surface finish RZ of between 4 -10µm. • Internal and external threads are cut with taps and dies. • Sheet metal and plastics are cut with hand lever cutters. • Pipes and tubing are cut to length. • Cold form metals sheets, pipes and profiles are made from ferrous and non ferrous metals. • Component drawings are read, interpreted and applied.	• Name and identify ▪ hand tools that may be used when cutting and forming ▪ and explain various parts of a drilling machine and a grinding machine • Explain ▪ how to care for cutting- and forming tools ▪ how to use cutting and forming tools ▪ various processes that are used when cutting and forming ▪ various thread types ▪ the purpose of work holding and how it is done ▪ the various aspects of safety when using chip making machinery ▪ what is meant by the following terms: chip making processes, friction, speed/strokes per second, revolutions per second, grinding, reaming, drilling, cutting, forming, filing, tapping • Saw plastic and metal sheets, plates and profiles as prescribed. • File and deburr surfaces and shape work pieces flat, square, parallel and angle to a measure and accuracy of +/- 2mm and to a surface finish of Rz of between 6.3 and 40µm. • Drill holes to a location tolerance of +/- 0.2mm by drilling, enlarging and profile countersinking and reaming, drilling holes to an accuracy as per IT7 and surface finish RZ of between 4 -10µm. • Cut ▪ internal and external threads with taps and dies. ▪ sheet metal and plastic with hand lever cutters. ▪ pipes and tubing to length. • Make cold form metal sheets, pipes and profiles from ferrous and non-ferrous metals. • Read, interpret and apply component drawings.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks on the theory. • Practical exercises on cutting and forming.	

SUBJECT OUTCOME	
3.3 Describe and perform joining and assembly. *Range: Assembly tools: screwdrivers (flat and Phillips), pliers (general purpose, long nose, pipe, circlip), spanners (adjustable wrenches, chain tongs, ring spanners, flat spanners, socket wrenches and sockets, allen keys, stillson wrenches, torque wrenches).* *Fasteners: Threaded fasteners (screws, bolts, nuts), auxiliary fasteners (split pins, washers, locking wires, locking fluid), general fasteners (glues, resins, anchoring systems).*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The use and care of assembly tools, and use and purpose of various fasteners are identified, named and explained. • The following are explained: ▪ the care that must be taken when using particular fasteners (adhesives etc). ▪ force, pressure, torque, shear force, tension, neck-out, fatigue, stretched, limit of elasticity, mechanical advantage. • Connections are made using screws, nuts and washers, securing with spring washers, tooth-lock washers and resins and assembly sequences considered. • Parts are identified in accordance with materials list and pre-assembling and are pinned with form fits, considering surface characteristics. • Lubricating and cooling devices are installed. • Pipes and tubing are connected and checked for leaks. • Components are fitted, aligned and secured for function. • Drive gears and couplings are installed. • Protective devices, guards and covers, insulation, ducts, cable trays and pipes are installed. • Assembly drawings are read, interpreted and applied.	• Identify, name and explain the use ▪ and care of assembly tools ▪ and purpose of various fasteners. • Explain ▪ the care that must be taken when using particular fasteners (adhesives etc). ▪ what is meant by the following terminology: force, pressure, torque, shear force, tension, neck-out, fatigue, stretched, limit of elasticity, mechanical advantage • Make connections using screws, nuts and washers, securing with spring washers, tooth-lock washers and resins. • Make connections in consideration of assembly sequences. • Pin parts with form fits, considering surface characteristics. • Identify parts in accordance to materials list and pre-assemble. • Installation of lubricating and cooling devices. • Connect pipe and tubing and check for leaks. • Fit components, align and secure for function. • Install drive gears and couplings. • Install protective devices, guards and covers and insulation. • Install ducts, cable trays, pipes. • Read, interpret and apply assembly drawings.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks addressing terms and terminology and assembly drawings. • Projects on assembly tools and fasteners. • Practical exercises on connections, parts, lubricating and cooling devices, pipes and tubing. • Observation sheets, checklists and rubrics on drive gears and couplings, protective devices, guards and covers and insulations, ducts, cable trays and pipes.	

Topic 4: Identify, select and use correct soldering and welding techniques when joining metals.

SUBJECT OUTCOME	
4.1 Explain and perform joining of metals by means of welding. *Range: arc welding, gas welding, gas cutting and MIG/TIG welding.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following terms, concepts and processes are explained: ▪ gas welding fuel requirements. ▪ what makes up the gas, TIG/MIG and /or arc welding system. ▪ setting up process of gas, MIG/TIG and/or arc welding equipment. ▪ metals and their properties and the weldability thereof. ▪ the arc welding process. ▪ the elements that make up an arc welding system.	• Explain ▪ gas welding fuel requirements. ▪ what makes up the gas, TIG/MIG and /or arc welding system. ▪ setting up process of gas, MIG/TIG and/or arc welding equipment. ▪ metals and their properties and the weldability thereof. ▪ the arc welding process. ▪ the elements that make up an arc welding system. ▪ gas and arc welding joining techniques to produce

▪ gas and arc welding joining techniques to produce work-pieces. ▪ problems that can occur when gas or arc welding/cutting. • Supplies for gas and arc welding are described and listed. • Welding drawings are read and interpreted. • The weldability of materials is assessed. • Welding methods, apparatus and materials are determined and selected for welding, material preparation and work area preparation for the safe welding of sheets, pipes, profiles in the correct position. • Brazing tools and fluxes are selected to perform safe brazing functions. • Safety procedures are applied and personal safety equipment and gas cutting techniques used whilst working.	work-pieces. ▪ problems that can occur when gas or arc welding or cutting. • Describe and list supplies for gas and arc welding. • Read and interpret welding drawings. • Assess weldability of materials. • Determine and select welding methods, apparatus and materials for welding, material preparation and work area preparation for the safe welding of sheets, pipes, profiles in the correct position • Select brazing tools and fluxes so as to perform safe brazing functions. • Apply ▪ safety procedures and use personal safety equipment whilst working. ▪ gas cutting techniques.
ASSESSMENT TASKS OR ACTIVITIES	
• Class questions, discussions and role-play on terms and concepts. • Practical exercises and demonstrations on joining of metals by means of welding.	

SUBJECT OUTCOME	
4.2 Explain and perform joining of metals by means of soldering. *Range: joining of cables and components to circuit boards and joining of sheet metals.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following are explained: ▪ what tools and equipment are required to perform soldering tasks ▪ how the selection of solder and fluxes take place ▪ how surface preparation is achieved ▪ various soldering techniques used in industry ▪ safety considerations when soldering. • Soldering tools and fluxes are identified and selected to make soldered joints safe. • Surface preparation, soldering techniques and safety considerations are applied whilst working.	• Explain ▪ what tools and equipment are required to perform soldering tasks ▪ how the selection of solder and fluxes take place ▪ how surface preparation is achieved ▪ various soldering techniques used in industry ▪ safety considerations related to soldering. • Identify and select soldering tools and fluxes so as to make soldered joints safe. • Apply ▪ surface preparation and soldering techniques. ▪ safety considerations whilst working.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or projects on the theory. • Practical exercises on joining of metals by means of soldering.	

Topic 5: Identify, plan and select correct work processes and materials when manufacturing and assembling mechatronic sub-systems.

SUBJECT OUTCOME	
5.1 Describe and apply housekeeping procedures in the workplace. *Range: joining of cables, components to circuit boards and joining of sheet metals.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The meaning of the term housekeeping is described. • The beneficial effect of good housekeeping and means of achieving this is explained. • Accidents due to poor housekeeping are listed. • The value and purpose of colour coding and symbolic signs are described. • Housekeeping procedures in the work area are applied and unsafe acts or conditions reported.	• Describe ▪ what is meant by housekeeping. ▪ the beneficial effect of good housekeeping. ▪ how good housekeeping can be achieved. • List possible accidents due to poor housekeeping. • Describe the value and purpose of ▪ colour coding. ▪ symbolic signs. • Apply housekeeping procedures in the work area. • Report any unsafe acts or conditions.
ASSESSMENT TASKS OR ACTIVITIES	
• An open-book test on applying house keeping procedures in the workplace.	

SUBJECT OUTCOME	
5.2 Name and apply job process and job procedure planning. *Range: Marking off, checking, measuring, forming, cutting and assembly processes, safety procedures, evacuation and accident reporting.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Job processes & tasks as used in a given manufacturing project are listed. • Various job processes that you would undertake to complete a given project are listed. • Written work task process cards are produced as given projects/instructions are achieved. • Work plans of given work projects are produced. *(work plans and process cards are to be signed off by the facilitator and the learner).*	• List ▪ job processes and tasks as used in a given manufacturing project. ▪ the various job processes to beundertaken to complete a given project. • Produce ▪ written work task process cards as given projects/instructions are achieved. ▪ work plan of given work projects (work plans and process cards are to be signed off by the facilitator and the learner).
ASSESSMENT TASKS OR ACTIVITIES	
• Checklists, rating scales and rubrics on work task process cards and work plans.	

SUBJECT OUTCOME	
5.3 Describe and use metals and plastics. *Range: ferrous and non-ferrous metals, plastics used in mechanical and electrical applications.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The classification of ferrous and non-ferrous metals, their main properties, and how to identify different metals using techniques such as sound, spark, strength tests and by machining are explained and described. • The colour code of metals used in industry and the characteristics of metals when heated are explained and described. • The properties and uses of plastics such as tufnol and nylon are described. • Correct material is selected and used in the specific manufacturing process.	• Explain and describe ▪ the classification of ferrous and non-ferrous metals. ▪ the main properties of ferrous and non-ferrous metals. ▪ how to identify different metals using techniques such as sound, spark, strength tests and by machining. ▪ the colour code of metals used in industry. ▪ characteristics of metals when heated. • Describe the properties and uses of plastics such as tufnol and nylon. • Select and use the correct material in the specific

	manufacturing process.
ASSESSMENT TASKS OR ACTIVITIES	
• A project on the use of metals and plastics.	

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN MANUAL MANUFACTURING – LEVEL 2

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 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 should be followed:

LEVEL 2	KNOWLEDGE AND COMPREHENSION	APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	30%	50%	20%

MARK ALLOCATION PER QUESTION		
Students complete four of five possible application questions covering all the topics.		
Question 1:	Identify and apply safety and health care during work.	15
Question 2:	Read, interpret, produce and apply engineering drawings to manufacture mechatronic sub-systems.	10
Question 3:	Identify, select, use and care for safety equipment, hand tools and power tools in the manufacture of mechatronic sub-systems.	25
Question 4:	Identify, select and use correct soldering and welding techniques when joining metals.	30
Question 5:	Identify, plan and select correct work processes and materials when manufacturing and assembling mechatronic sub-systems.	20
	TOTAL	100