



higher education
& training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

FITTING AND TURNING

NQF LEVEL 3

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FITTING AND TURNING - LEVEL 3

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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 the subject *Fitting and Turning Level 3* 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 internal and external subject assessment. The lecturer must use this document with the *Subject Guidelines: Fitting and Turning Level 3* to prepare for and deliver Fitting and Turning. 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 resource 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 in order 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 components of the delivery system.

- **Portability**

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

- **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 that assessment covers a broad range of the knowledge, skills, values and attitudes (KSVAs) 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 ensure that assessment practices are consistent so that the same result or judgement 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 that of 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 (KSVAs) 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 paper(s) set to the requirements of the Subject Learning Outcomes. The Department of Higher Education and Training 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 ISAT is the most significant test of students’ ability to apply their acquired knowledge.

The integrated assessment approach allows students to be assessed in more than one subject with the same 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 Higher Education and Training (DHET), 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 that proper procedures are followed;
- ensures that 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 assurer; and
- moderates in case of a dispute between an assessor and a student.

Policy on inclusive education requires that assessment procedures for students who experience barriers to learning be customised and supported to enable these students to achieve to 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 ICASS must be re-submitted with each examination enrolment for which it constitutes a component.

5 ASSESSOR REQUIREMENTS

Assessors must be subject specialists and competent assessors.

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 (KSVAs) that students bring to the classroom. This knowledge assists lecturers in planning 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 for making 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 achievement in 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 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 for 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 that cannot be compared to tests. Each criterion described in the rubric must be assessed separately. Mainly two types of rubrics are used, namely holistic and analytical.

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 as evaluation of specific tasks. However, marks should be awarded against rubrics and should not simply be a total of ticks for right answers. Rubrics should explain the competence level descriptors for the knowledge, skills, values and attitudes (KSVAs) 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 it 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 record observations of 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.

ASSESSMENT IN FITTING AND TURNING

LEVEL 3

SECTION C: ASSESSMENT IN FITTING AND TURNING LEVEL 3

1. ASSESSMENT SCHEDULE AND REQUIREMENTS

Internal and external assessments are conducted and the results of both contribute to the final mark of a student in the subject.

The internal continuous assessment (ICASS) mark accounts for 50 percent and the external examination mark for 50 percent of the final mark. A student needs a minimum final mark of 50 percent to enable a pass in the subject.

1.1 Internal assessment

Lecturers must compile a detailed assessment plan and assessment schedule of internal assessments to be undertaken during the year in the subject (e.g. date, assessment task/or activity, rating code/marks allocated, assessor, moderator).

All internal assessments are then conducted according to the plan and schedule using appropriate assessment instruments and tools for each assessment task (e.g. tests, assignments, practical tasks/projects and memoranda, rubrics, checklists).

The marks allocated to both the minimum number of practical and written assessment tasks conducted during the internal continuous assessment (ICASS) are kept and recorded in the Portfolio of Evidence (PoE) which is subjected to internal and external moderation.

A year mark out of 100 is calculated from the ICASS marks contained in the PoE and submitted to the DHET on the due date towards the end of the year.

The following internal assessment units currently **GUIDE** the internal assessment of Fitting and Turning Level 2.

TASKS	Time-frame	Type of assessment activity	Minimum time and proposed mark allocation (*can be increased but not reduced)	Scope of assessment	% contribution to the year
				Do not confuse the weightings of topics in the Subject Guidelines with the % contribution to the year mark	
1	Term 1	Test	1 hour (50 marks)	Topics completed in Term 1	10
2	Term 1	Practical Assessment/ Assignment	Determined by the scope and nature of the task	One or more of the topics completed as an assignment	25
3	Term 2	Practical Assessment/ Assignment	Determined by the scope and nature of the task	One or more of the topics completed as an assignment	25
4	Term 2	Test*	1 hour (50 marks)	Topics completed in Term 1 and 2	10
5	Term 3	Internal Examination*	As per external examinations (P1 & P2 where applicable)	Topics completed to date (P1 =15 & P2=15, where applicable)	30
TOTAL					100

Specifications for internal assessment may change over time. A separate internal assessment guideline document '*Guidelines for the Implementation of Internal Continuous Assessment (ICASS) in the NC(V) qualifications at FET Colleges*' has been developed, and is updated and available on the Departmental website. The conduct and administration of internal assessments must always comply with specifications contained in the most current version of the guideline document.

2 RECORDING AND REPORTING

Fitting and Turning is assessed according to five levels of competence. The level descriptions are explained in the following table.

<i>Scale of Achievement for the Vocational component</i> 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 planned and scheduled assessment should be recorded in the lecturer's Portfolio of Assessment (PoA) for each subject. The minimum requirements for the **lecturer's Portfolio of Assessment** should be as follows:

- Lecturer information
- A contents page
- Subject and Assessment Guidelines
- A subject Year plan /Work scheme/Pace Setter
- A subject assessment plan
- Instrument(s) (tests, assignments, practical) and tools (memoranda, rubrics, checklists) for each assessment task
- A completed pre-moderation checklist for each of the ICASS tasks and their accompanying assessment tools
- A completed post-moderation checklist once the task has been administered and assessed
- Subject record sheets per level/class reflecting the marks achieved by students in the ICASS tasks completed
- Evidence of review – diagnostic and statistical analysis, including notes on improvement of the task for future use

The college could standardise these documents.

The minimum requirements for the **student's Portfolio of Evidence (PoE)** should be as follows:

- Student information/identification
- Declaration of authenticity form – duly completed (signed and dated)
- A contents page/list of content (for accessibility)
- A subject assessment schedule
- The evidence of marked assessment tasks and feedback according to the assessment schedule
- A summary record of results showing all the marks achieved per assessment for the subject
- Evidence of moderation (only where applicable for students whose tasks were moderated)

Where tasks cannot be contained in the Portfolio of Evidence (PoE), their exact location must be recorded and they must be readily available for moderation purposes.

The following units guide internal assessment in Fitting and Turning Level 3.

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN FITTING AND TURNING – LEVEL 3

Topic 1: Bearings

SUBJECT OUTCOME	
1.1 Explain correct safety procedures and care when maintaining bearings in machines and equipment	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The worksite health and safety practices are explained. <i>Range:</i> <i>Safety procedures include excerpts from the Driven Machinery Regulations. Safety measures include the impact on human beings, machines, equipment, materials and the environment.</i> 	<ul style="list-style-type: none"> Explain worksite health and safety practices.
<ul style="list-style-type: none"> The importance of a clean working area is explained. 	<ul style="list-style-type: none"> Explain the importance of a clean working area.
<ul style="list-style-type: none"> Good housekeeping is explained. 	<ul style="list-style-type: none"> Explain good housekeeping.
<ul style="list-style-type: none"> The safety precautions before and after replacing bearings are explained. <i>Range:</i> <i>Bearing safety includes the application of personal protective equipment, assembly, dismantling start-up procedures, protective guards and other best practice procedures.</i> 	<ul style="list-style-type: none"> Explain the safety precautions before and after replacing bearings.
<ul style="list-style-type: none"> The necessity for using correct tools, equipment and cleaning materials is explained. 	<ul style="list-style-type: none"> Explain why it is necessary to use correct tools, equipment and cleaning materials.
<ul style="list-style-type: none"> Appropriate safety clothing is identified and their importance explained. 	<ul style="list-style-type: none"> Identify appropriate safety clothing and explain its importance.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

SUBJECT OUTCOME	
1.2 Demonstrate an understanding of plain and anti-friction bearings.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The functions of bearings are explained 	<ul style="list-style-type: none"> Explain the functions of bearings

<ul style="list-style-type: none"> The different types of plain (sliding) bearings are identified. <i>Range:</i> <i>Types of plain (sliding) bearings include pedestal bearing; plain split bearing; plumber-block bearing; taper bearing; hanger bearing; single and multi-collar thrust bearings; footstep bearing; Mitchell thrust bearing and machine slides.</i> 	<ul style="list-style-type: none"> Identify the different types of plain (sliding) bearings.
<ul style="list-style-type: none"> The advantages and disadvantages of plain (sliding) bearings are stated. <i>Range:</i> <i>Includes the ability to differentiate between solid and split bearings and bushes</i> 	<ul style="list-style-type: none"> State the advantages and disadvantages of plain (sliding) bearings.
<ul style="list-style-type: none"> Plain bearings are categorised according to load carrying ability. <i>Range:</i> <i>Radial, thrust and combined loads.</i> <i>Load-types are demonstrated with the aid of sketches.</i> 	<ul style="list-style-type: none"> Categorise plain bearings according to load carrying ability.
<ul style="list-style-type: none"> The properties and applications of plain bearing materials are described. <i>Range:</i> <i>The properties include embeddability, load capacity, thermal conductivity, cost, fatigue strength, corrosion resistance, compatibility, conformability.</i> <i>Applications of plain bearing materials include cast-iron, bronze, white metal, nylon and tufnol.</i> 	<ul style="list-style-type: none"> Describe the properties and applications of plain bearing materials
<ul style="list-style-type: none"> The following rolling bearings are identified from a given drawing and named: <i>Range:</i> <i>Rolling bearings include single and double row radial ball bearing, single and double row radial cylindrical roller bearing, thrust ball and roller bearing (single and double row), single row angular contact ball bearing, spherical (barrel) roller bearing, tapered roller bearing, self-aligning bearing (ball and roller), needle roller bearings.</i> 	<ul style="list-style-type: none"> Identify the following rolling bearings from a given drawing and name them.
<ul style="list-style-type: none"> Advantages and disadvantages of anti-friction bearings are stated. 	<ul style="list-style-type: none"> State the advantages and disadvantages of anti-friction bearings.
<ul style="list-style-type: none"> The different types of bearing seals are discussed. <i>Range:</i> <i>Includes shields and seals which are removable and non-removable, rubber-types, metal, stainless steel, and synthetic material-types, and pre-packed types.</i> 	<ul style="list-style-type: none"> Discuss the different types of bearing seals.
<ul style="list-style-type: none"> The main components of anti-friction bearings are identified and named. <i>Range:</i> <i>All components.</i> 	<ul style="list-style-type: none"> Identify and name the main components of anti-friction bearings.

ASSESSMENT TASKS OR ACTIVITIES

- Knowledge questionnaire
- Assignment/presentation
- Interview (oral) in order to evaluate ability to recall information

SUBJECT OUTCOME	
1.3 Plan and prepare for bearing replacement.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Documents are obtained and bearing history investigated. 	<ul style="list-style-type: none"> Obtain documents and investigate bearing history.
<ul style="list-style-type: none"> Engineering drawings are interpreted. 	<ul style="list-style-type: none"> Interpret engineering drawings.
<ul style="list-style-type: none"> Maintenance schedule is determined. 	<ul style="list-style-type: none"> Determine maintenance schedule.
<ul style="list-style-type: none"> The types of bearings are identified. 	<ul style="list-style-type: none"> Identify type of bearing.
<ul style="list-style-type: none"> The appropriate tools and equipment for the job are identified. 	<ul style="list-style-type: none"> Identify appropriate tools and equipment for the job.
<ul style="list-style-type: none"> The bearing replacement that must be completed is explained. 	<ul style="list-style-type: none"> Explain bearing replacement to be completed.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Knowledge questionnaire Assignment/presentation Interview (oral) in order to evaluate ability to recall information

SUBJECT OUTCOME	
1.4. Prepare site and equipment for bearing replacement.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Equipment is isolated electrically from other energy sources. 	<ul style="list-style-type: none"> Isolate equipment electrically from other energy sources.
<ul style="list-style-type: none"> Equipment is isolated mechanically from other energy sources. 	<ul style="list-style-type: none"> Isolate equipment mechanically from other energy sources.
<ul style="list-style-type: none"> The appropriate tools and equipment are selected. 	<ul style="list-style-type: none"> Select appropriate tools and equipment.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

SUBJECT OUTCOME	
1.5. Check bearings	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Bearings assemblies are inspected for conformance to manufacturer's specifications. 	<ul style="list-style-type: none"> Inspect bearing assemblies for conformance to manufacturer's specifications.
<ul style="list-style-type: none"> The bearing lubrication is checked. 	<ul style="list-style-type: none"> Check bearing lubrication.
<ul style="list-style-type: none"> The bearing cooling devices are checked. 	<ul style="list-style-type: none"> Check bearing cooling devices.

<ul style="list-style-type: none"> Bearing diagnostic equipment is used to establish bearing conditions. 	<ul style="list-style-type: none"> Determine/establish bearing conditions using diagnostic equipment.
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ASSESSMENT TASKS OR ACTIVITIES

<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations
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SUBJECT OUTCOME

1.6 Maintain, remove, inspect and install bearings.

Range:

- Description of the main parts, practical uses, mounting procedures, adjustment and operation of all plain bearings.*
- The maintenance of plain bearings includes causes of bearing failure and overheating; procedures for taking up wear.*
- Maintenance on plain (sliding) bearings may include work on a pedestal bearing; plain split bearing; plumber-block bearing; taper bearing; hanger bearing; single and multi-collar thrust bearings; footstep bearing; Mitchell thrust bearing and machine slides.*
- Maintenance on rolling or anti-friction bearings includes work on single and double row radial ball bearing, single and double row radial cylindrical roller bearing, thrust ball and roller bearing (single and double row), single row angular contact ball bearing, spherical (barrel) roller bearing, tapered roller bearing, self-aligning bearing (ball and roller), needle roller bearings.*
- Maintenance/removal/installation of anti-friction bearings includes fitting, mounting, describing bearing failures and cleaning procedures.*
- Removal includes use of screw puller, impact puller, hydraulic puller and puller plates, use of hydraulic press or hammer.*
- Mounting/installation – onto shaft/housing – heating methods (oil bath, heating lamps, induction heater) and use of hydraulic press or hammer and punch/sleeve.*

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The bearings and/or assemblies are removed. 	<ul style="list-style-type: none"> Remove bearings and/or assemblies.
<ul style="list-style-type: none"> The bearing parts are identified. 	<ul style="list-style-type: none"> Identify the bearing parts.
<ul style="list-style-type: none"> The bearing assemblies are stripped. <i>Range: Removal – use of screw puller, impact puller, hydraulic puller and puller plates</i> 	<ul style="list-style-type: none"> Strip bearing assemblies.
<ul style="list-style-type: none"> The bearing and associated parts are cleaned using proper cleaning procedures (<i>no spinning of bearing, use of pressurised air is prohibited</i>) 	<ul style="list-style-type: none"> Clean bearings and associated parts.
<ul style="list-style-type: none"> The bearings are inspected for damage and wear. <i>Range: Inspection of bearings includes inspection of bearing assemblies for conformance to specifications, bearing lubrication checks, bearing cooling checks.</i> 	<ul style="list-style-type: none"> Inspect for damage and wear.
<ul style="list-style-type: none"> The bearing parts to replace are selected. 	<ul style="list-style-type: none"> Select bearing parts to replace.
<ul style="list-style-type: none"> The fitting equipment is selected. 	<ul style="list-style-type: none"> Select fitting equipment.

<ul style="list-style-type: none"> The bearing assemblies are installed in accordance with manufacturer's specifications. <i>Range: Mounting/installation – onto shaft/housing – heating methods (oil bath, heating lamps, induction heater).</i> 	<ul style="list-style-type: none"> Install bearing assemblies in accordance with manufacturer's specifications.
<ul style="list-style-type: none"> The locking devices are secured in accordance with machine requirements. 	<ul style="list-style-type: none"> Secure locking devices in accordance with machine requirements.
<ul style="list-style-type: none"> The correct sequence of activities to follow when maintaining bearings is explained and performed 	<ul style="list-style-type: none"> Explain and perform correct sequence of activities to follow when maintaining bearings
<ul style="list-style-type: none"> Possible incorrect decisions that can be taken during the maintaining of bearings are described. 	<ul style="list-style-type: none"> Describe possible incorrect decisions that can be taken during the maintaining of bearings.
<ul style="list-style-type: none"> The implications of incorrect sequencing of activities and operations are explained <i>Range: Correct bearing handling procedures are demonstrated; pre-load methods include deadweight, spring and solid clamping and handling conditions related to safety of self and efficiency of bearing</i> 	<ul style="list-style-type: none"> Explain the implications of incorrect sequencing of activities and operations.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME

1.7 Conduct quality checks after installation and record information.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The replacement parts are checked. 	<ul style="list-style-type: none"> Check replacement parts.
<ul style="list-style-type: none"> The replacement parts are tested. 	<ul style="list-style-type: none"> Test replacement parts.
<ul style="list-style-type: none"> During the quality checking process, appropriate safety practices are applied. 	<ul style="list-style-type: none"> Apply appropriate safety practices during the quality checking process.
<ul style="list-style-type: none"> A new file is opened and named or an existing file is used. 	<ul style="list-style-type: none"> Open a new file and name it or use an existing file.
<ul style="list-style-type: none"> Information on the completed job is accurately recorded. 	<ul style="list-style-type: none"> Accurately record information on the completed job.
<ul style="list-style-type: none"> The information is stored in a safe place. 	<ul style="list-style-type: none"> Store information in a safe place.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

Topic 2: Couplings

SUBJECT OUTCOME	
2.1 Work safely with couplings	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Worksite health, safety and environmental protective practices are explained and applied. <p><i>Range:</i> Safety procedures include excerpts from the Driven Machinery Regulations. Safety measures include the impact on human beings, machines, equipment, materials and the environment.</p>	<ul style="list-style-type: none"> Explain and apply worksite health, safety and environmental protective practices.
<ul style="list-style-type: none"> Good housekeeping is applied. 	<ul style="list-style-type: none"> Apply good housekeeping.
<ul style="list-style-type: none"> The best practice safety measures for working with couplings are recalled. <p><i>Range:</i> Coupling/machine safety includes the application of personal protective equipment, assembly, dismantling start-up procedures, protective guards and other best practice procedures.</p>	<ul style="list-style-type: none"> Recall best practice safety measures for working with couplings.
<ul style="list-style-type: none"> Awareness of the need to keep equipment, materials and machines clean after use is demonstrated. 	<ul style="list-style-type: none"> Demonstrate awareness of the need to keep equipment, materials and machines clean after use.
<ul style="list-style-type: none"> Personal protective equipment is worn during the maintenance and overhaul of couplings. 	<ul style="list-style-type: none"> Wear personal protective equipment during the maintenance and overhaul of couplings.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

SUBJECT OUTCOME	
2.2 Demonstrate an understanding of couplings.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The working principle/s, function and application of couplings are listed. <p><i>Range:</i> Guidelines for demonstrating and understanding of couplings include: Explanation of the difference in operation between a coupling and a clutch</p>	<ul style="list-style-type: none"> List the working principle/s, function and application of couplings.
<ul style="list-style-type: none"> Correct terminology associated with couplings is used. 	<ul style="list-style-type: none"> Use correct terminology associated with couplings.
<ul style="list-style-type: none"> Various types and applications of couplings are listed. <p><i>Range:</i></p> <ul style="list-style-type: none"> Classification of the different types of couplings into THREE main groups, namely 	<ul style="list-style-type: none"> List the various types and applications of couplings.

<p><i>rigid/permanent; flexible and self-aligning types. A description (with the aid of given drawings) of the different types of couplings should be included for fixed/permanent types (flange, marine, chain, gear, Oldham fluid types); flexible types (Raffard, pin- and rubber-bush, rubber belt, Bibby, tyre coupling (fenner flex), spider, nylon sleeve, metal disc); self-aligning types (universal or Hooke's coupling, CV-joint).</i></p> <ul style="list-style-type: none"> • A description should also include an explanation of the application and construction of each type, with examples. • Identification of sub-components of each coupling type. 	
<ul style="list-style-type: none"> • Different conditions under which certain types of couplings are used in engineering systems, are explained 	<ul style="list-style-type: none"> • Explain the different conditions under which certain types of couplings are used in engineering systems.
<ul style="list-style-type: none"> • The different types of misalignment are described and techniques explained for achieving coupling alignment after re-assembly to the machine or engineering system. <p><i>Range: A brief description of the assembly and alignment of couplings. Note that types of misalignment may be described (angular, radial, axial). This should include a brief description of the various aligning techniques (simple, double-clock and laser alignment).</i></p>	<ul style="list-style-type: none"> • Describe the different types of misalignment and explain techniques for achieving coupling alignment after re-assembly to the machine or engineering system.
<ul style="list-style-type: none"> • Common faults and remedies associated with the use of couplings on machines are listed. 	<ul style="list-style-type: none"> • List common faults and remedies associated with the use of couplings on machines.

ASSESSMENT TASKS OR ACTIVITIES

<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations
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SUBJECT OUTCOME

2.3 Plan and prepare materials and equipment for the dismantling and repair of couplings.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Drawings and work instructions for the job are interpreted 	<ul style="list-style-type: none"> • Interpret drawings and work instructions for the job
<ul style="list-style-type: none"> • Components and consumables are selected for the job. 	<ul style="list-style-type: none"> • Select components and consumables for the job.
<ul style="list-style-type: none"> • The correct coupling and/or clutch or associated components (where applicable) are identified for the job. 	<ul style="list-style-type: none"> • Identify the correct coupling and/or clutch or associated components (where applicable) for the job.
<ul style="list-style-type: none"> • Typical manufacturers' specification sheets and/or prescribed guidelines are read and understood. 	<ul style="list-style-type: none"> • Read and understand typical manufacturers' specification sheets and/or prescribed guidelines.
<ul style="list-style-type: none"> • Correct and safe methods are applied for the maintenance, repair and overhaul of couplings. 	<ul style="list-style-type: none"> • Apply correct and safe methods for the maintenance, repair and overhaul of couplings

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
2.4 Dismantle, assemble and align couplings	
<i>Range:</i>	
<ul style="list-style-type: none"> • This task may be simulated with a typical workshop coupling station. • A typical flange-type coupling may be used for this purpose although a Bibby or similar-type may be used. • Alignment method should be basic with the aid of an engineering square, feather gauge and feelers (clock gauge is optional) 	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The coupling is removed from the machine. 	<ul style="list-style-type: none"> • Remove the coupling from the machine.
<ul style="list-style-type: none"> • The coupling is inspected on-site or in the repair workshop. 	<ul style="list-style-type: none"> • Inspect the coupling on-site or in the repair workshop.
<ul style="list-style-type: none"> • The coupling is dismantled according to the prescribed method. 	<ul style="list-style-type: none"> • Dismantle the coupling according to the prescribed method.
<ul style="list-style-type: none"> • The components are inspected for wear and their condition is evaluated. 	<ul style="list-style-type: none"> • Inspect the components for wear and evaluate the condition.
<ul style="list-style-type: none"> • The coupling is lubricated and re-assembled according to the prescribed method 	<ul style="list-style-type: none"> • Lubricate and re-assemble the coupling according to the prescribed method
<ul style="list-style-type: none"> • The coupling is refitted and aligned to the machine or engineering system 	<ul style="list-style-type: none"> • Refit and align the coupling to the machine or engineering system
<ul style="list-style-type: none"> • The finishing processes are conducted in preparation for quality inspection. 	<ul style="list-style-type: none"> • Conduct finishing processes in preparation for quality inspection.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
2.5 Apply quality checks and store equipment.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Factors associated with quality checking of completed assembly work for couplings are identified. 	<ul style="list-style-type: none"> • Identify factors associated with the quality checking of completed assembly work for couplings.
<ul style="list-style-type: none"> • A report is written. 	<ul style="list-style-type: none"> • Write a report.

• The tools and equipment are cleaned.	• Clean tools and equipment.
• The lubricating oil is applied sparingly to the equipment for preservation.	• Apply lubricating oil sparingly to equipment for preservation.
• The equipment is stored and placed in a toolbox and/or returned to store-room	• Store equipment and place equipment in a toolbox and/or return to store-room.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

Topic 3: Brakes and Clutches

SUBJECT OUTCOME	
3.1 Demonstrate an understanding of brake systems.	
<p><i>Range:</i></p> <ul style="list-style-type: none"> • <i>This topic and this subject outcome are restricted to the following brake systems: disc, drum, thruster and electromagnetic brake systems.</i> • <i>Simple line sketches may be used to explain and describe the working principles of types of brake systems.</i> 	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
• The function and purpose of brake systems are explained and compared with couplings.	• Explain the function and purpose of brake systems and compare these with couplings.
• The working principles of different types of brake systems are explained.	• Explain the working principles of different types of brake systems.
• The application of different types of brake systems is described.	• Describe the application of different types of brake systems.
• The advantages and disadvantages of using one type of brake system instead of another are explained.	• Explain the advantages and disadvantages of using one type of brake system instead of another.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
3.2 Demonstrate an understanding of clutches.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<p><i>Range:</i></p> <ul style="list-style-type: none"> • <i>This topic and this subject outcome are restricted to friction clutch systems: single and multi-plate,</i> 	

<p><i>centrifugal (loose weight and fixed weight types), cone and torque-limiter).</i></p> <ul style="list-style-type: none"> • <i>Simple line sketches may be used to explain and describe the working principles of clutch-types.</i> 	
<ul style="list-style-type: none"> • The function and purpose of clutches are explained and compared with couplings. 	<ul style="list-style-type: none"> • Explain the function and purpose of clutches and compare these with couplings.
<ul style="list-style-type: none"> • The working principles of different types of clutch systems are explained. 	<ul style="list-style-type: none"> • Explain the working principles of different types of clutch systems.
<ul style="list-style-type: none"> • The application of different types of clutches is described. 	<ul style="list-style-type: none"> • Describe the application of different types of clutches.
<ul style="list-style-type: none"> • The advantages and disadvantages of using one type of clutch system instead of another are explained and discussed. 	<ul style="list-style-type: none"> • Explain and discuss the advantages and disadvantages of using one type of clutch system instead of another.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
3.3 Explain correct safety procedures and care during the removal, replacement and maintenance of brakes and clutch systems.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Worksite health and safety practices for brake and clutch maintenance are explained. <i>Range: Safety procedures include excerpts from the Driven Machinery Regulations. Safety measures include the impact on human beings, machines, equipment, materials and the environment.</i> 	<ul style="list-style-type: none"> • Explain worksite health and safety practices for brake and clutch maintenance
<ul style="list-style-type: none"> • The need for good housekeeping is explained. 	<ul style="list-style-type: none"> • Explain the need for good housekeeping.
<ul style="list-style-type: none"> • The importance of a clean working area and the appropriate use of cleaning materials is explained. 	<ul style="list-style-type: none"> • Explain the importance of a clean working area and the appropriate use of cleaning materials.
<ul style="list-style-type: none"> • The appropriate safety clothes and masks are identified and their importance explained. <i>Range: Safety includes the use of personal protective equipment during dismantling, repair, mounting or checking, start-up procedures, protective guards and other best practice procedures.</i> 	<ul style="list-style-type: none"> • Identify the appropriate safety clothes and masks and explain their importance.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
3.4 Plan and prepare for brake and clutch maintenance.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The job card is read and interpreted. 	<ul style="list-style-type: none"> • Read and interpret the job card.
<ul style="list-style-type: none"> • The relevant documents are obtained. 	<ul style="list-style-type: none"> • Obtain relevant documents.
<ul style="list-style-type: none"> • The engineering drawings are interpreted. 	<ul style="list-style-type: none"> • Interpret engineering drawings.
<ul style="list-style-type: none"> • Maintenance procedures are scheduled. 	<ul style="list-style-type: none"> • Schedule maintenance procedures.
<ul style="list-style-type: none"> • The appropriate tools and equipment are selected. 	<ul style="list-style-type: none"> • Select appropriate tools and equipment.
<ul style="list-style-type: none"> • The complete assembly is cleaned and inspected. 	<ul style="list-style-type: none"> • Clean and inspect the complete assembly.
<ul style="list-style-type: none"> • The wear on the linings and score marks on the friction surface are identified. 	<ul style="list-style-type: none"> • Identify the wear on the linings and score marks on the friction surface.
<ul style="list-style-type: none"> • Equipment is isolated electrically from other energy sources. 	<ul style="list-style-type: none"> • Isolate equipment electrically from other energy sources.
<ul style="list-style-type: none"> • Equipment is isolated mechanically from other energy sources. 	<ul style="list-style-type: none"> • Isolate equipment mechanically from other energy sources.
<ul style="list-style-type: none"> • The load is supported before the brake or clutch is released, removed, adjusted, lowered or worked on. 	<ul style="list-style-type: none"> • Support the load before the brake or clutch is released, removed, adjusted, lowered or worked on.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
3.5 Demonstrate an understanding of brake and clutch inspection and checking	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Assemblies are inspected for conformance to manufacturer's specifications. 	<ul style="list-style-type: none"> • Inspect assemblies for conformance to manufacturer's specifications.
<ul style="list-style-type: none"> • The air gaps are measured according to manufacturer's specifications. 	<ul style="list-style-type: none"> • Measure the air gaps according to manufacturer's specifications.
<ul style="list-style-type: none"> • The hydraulic systems are inspected for leaks. 	<ul style="list-style-type: none"> • Inspect the hydraulic systems for leaks.
<ul style="list-style-type: none"> • The friction area is inspected for wear. 	<ul style="list-style-type: none"> • Inspect the friction area for wear.
<ul style="list-style-type: none"> • Brakes and clutches are measured and adjusted according to manufacturer's specifications. 	<ul style="list-style-type: none"> • Measure and adjust brakes and clutches according to manufacturer's specifications.
<ul style="list-style-type: none"> • The appropriate safety practices are applied during the process. 	<ul style="list-style-type: none"> • Apply appropriate safety practices during the process.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

Topic 4: V-Belt Drives

SUBJECT OUTCOME	
4.1 Demonstrate an understanding of v-belt drives	
<i>Range:</i>	
<ul style="list-style-type: none"> • Types of v-belts and v-belt drives are identified according to manufacturers' specification and design and includes the use of v-belt drive terms, components and functions from given drawings. • Students must be exposed (briefly) to different types of belts (example: flat-, tooth-, wedge-types) • Factors determining selection of v-belts; application of v-belts; advantages and disadvantages of v-belt drives when compared with chain and gear drives. • Common and special v-belt types and their composition are represented by means of a sectional drawing. Includes SPZ; SPA; SPB; and SPC types only. • Sketches may include v-belt pulleys for single and multiple belt drives and include driven pulley, drive pulley, jockey, idler, centre distance, belt tension in kg/m² or Newton. 	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The application of v-belts is explained. 	<ul style="list-style-type: none"> • Explain the application of v-belts.
<ul style="list-style-type: none"> • The advantages and disadvantages of v-belt drives over chain and gear drives are explained 	<ul style="list-style-type: none"> • Explain the advantages and disadvantages of v-belt drives over chain and gear drives.
<ul style="list-style-type: none"> • Common and special v-belt types are named. 	<ul style="list-style-type: none"> • Name common and special v-belt types.
<ul style="list-style-type: none"> • V-belt drive terms are identified and components indicated from given drawings 	<ul style="list-style-type: none"> • Identify v-belt drive terms and indicate components from given drawings
<ul style="list-style-type: none"> • V-belt drive terms and the functions of the components are explained. 	<ul style="list-style-type: none"> • Explain v-belt drive terms and the functions of components.
<ul style="list-style-type: none"> • A sectional drawing representing the composition of a v-belt is produced. 	<ul style="list-style-type: none"> • Represent the composition of a v-belt, by means of a sectional drawing.
<ul style="list-style-type: none"> • The distinction between v-belt pulleys for single and multiple belt drives is shown in a simple drawing. 	<ul style="list-style-type: none"> • Distinguish between v-belt pulleys for single and multiple belt drives using a simple drawing.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
4.2 Explain correct safety procedures and care when working with v-belt drives.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Worksite health and safety practices when working with v-belt drives are explained. <i>Range:</i> <i>Safety procedures include excerpts from the Driven Machinery Regulations. Safety measures include the impact on human beings, machines, equipment, materials and the environment.</i> 	<ul style="list-style-type: none"> Explain worksite health and safety practices when working with v-belt drives.
<ul style="list-style-type: none"> Good housekeeping is explained. 	<ul style="list-style-type: none"> Explain good housekeeping.
<ul style="list-style-type: none"> The safety precautions to take when working with v-belt drives are explained <i>Range:</i> <ul style="list-style-type: none"> <i>Belt drive safety includes the use of personal protective equipment, safety precautions for mounting, removal, disassembly, start-up procedures, protective guards and other best practice procedures.</i> <i>V-belts are listed as transmission belts in the Driven Machinery Regulations</i> 	<ul style="list-style-type: none"> Explain the safety precautions to take when working with v-belt drives
<ul style="list-style-type: none"> Personal protective equipment is identified and its importance explained. 	<ul style="list-style-type: none"> Identify appropriate personal protective equipment and explain its importance.
<ul style="list-style-type: none"> The importance of a clean working area and the need for effective cleaning equipment, materials and machines are explained. 	<ul style="list-style-type: none"> Explain the importance of a clean working area and the need for effective cleaning equipment, materials and machines.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

SUBJECT OUTCOME	
4.3 Plan and prepare for v-belt maintenance.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> A job card is read and documentation and engineering drawings are interpreted. 	<ul style="list-style-type: none"> Read and interpret a job card, obtain documentation and interpret engineering drawings.
<ul style="list-style-type: none"> Personnel requirements are identified and maintenance procedures scheduled. 	<ul style="list-style-type: none"> Identify personnel requirements and schedule maintenance procedures.
<ul style="list-style-type: none"> The appropriate tools and equipment are selected. 	<ul style="list-style-type: none"> Select appropriate tools and equipment.
<ul style="list-style-type: none"> The complete assembly is cleaned and inspected. 	<ul style="list-style-type: none"> Clean and inspect the complete assembly.
<ul style="list-style-type: none"> The potential areas of defectiveness and wear are listed. 	<ul style="list-style-type: none"> List the potential areas of defectiveness and wear.

<ul style="list-style-type: none"> The equipment is isolated electrically from other energy sources. 	<ul style="list-style-type: none"> Isolate equipment electrically from other energy sources.
<ul style="list-style-type: none"> The equipment is isolated mechanically from other energy sources. 	<ul style="list-style-type: none"> Isolate equipment mechanically from other energy sources.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME

4.4 Dismantle and assemble v-belt drives

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<i>Range:</i>	
<i>Includes: Checking of v-belt sizes and lengths; maintenance, fault finding and diagnosis; alignment and tensioning; installation of v-belt drives; elimination and accommodation of belt deflection</i>	
<ul style="list-style-type: none"> The v-belt drive is disassembled. 	<ul style="list-style-type: none"> Disassemble the v-belt drive.
<ul style="list-style-type: none"> The v-belt drive assembly components are identified. 	<ul style="list-style-type: none"> Identify v-belt drive assembly components.
<ul style="list-style-type: none"> The belt drive assembly is removed 	<ul style="list-style-type: none"> Remove the belt drive assembly
<ul style="list-style-type: none"> The parts are inspected for non-conformances. 	<ul style="list-style-type: none"> Inspect parts for non-conformances.
<ul style="list-style-type: none"> The parts are cleaned. 	<ul style="list-style-type: none"> Clean parts.
<ul style="list-style-type: none"> The belt drive assembly and components are assembled. 	<ul style="list-style-type: none"> Assemble the belt drive assembly and components.
<ul style="list-style-type: none"> Appropriate safety practices are applied during the process. 	<ul style="list-style-type: none"> Apply appropriate safety practices during the process.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME

4.5 Perform quality checks and job completion procedures

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Quality checks are conducted. 	<ul style="list-style-type: none"> Conduct quality checks.
<ul style="list-style-type: none"> The replacement parts are measured and tested and performance evaluated. 	<ul style="list-style-type: none"> Measure and test replacement parts and evaluate performance.
<ul style="list-style-type: none"> Information on the completed job is accurately recorded. 	<ul style="list-style-type: none"> Record information accurately on the completed job.

<ul style="list-style-type: none"> • A new file is opened and named or an existing file is used and information is stored in a safe place. 	<ul style="list-style-type: none"> • Open a new file and name it or use an existing file and store information in a safe place.
<ul style="list-style-type: none"> • The equipment and tools are cleaned and maintained. 	<ul style="list-style-type: none"> • Clean and maintain equipment and tools.
<ul style="list-style-type: none"> • A report on defective tools and equipment is drawn up and procedures for discard or repair are facilitated. 	<ul style="list-style-type: none"> • Report on defective tools and equipment and facilitate discard procedures or repair.
<ul style="list-style-type: none"> • The equipment and tools are stored in an authorised place. 	<ul style="list-style-type: none"> • Store equipment and tools in an authorised place.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

Topic 5: Chain Drives

SUBJECT OUTCOME	
5.1 Demonstrate an understanding of chain drives	
<p><i>Range:</i></p> <ul style="list-style-type: none"> • <i>Types of chain and chain drives are identified according to manufacturers' specifications and design and includes the use chain drive terms, components and functions from given drawings.</i> • <i>The following procedures must be explained: checking of chain sizes and lengths; maintenance, fault finding and diagnosis; alignment and tensioning; installation of chain drives; description and explanation of chain deflection.</i> 	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The application of chain drives is explained. 	<ul style="list-style-type: none"> • Explain the application of chain drives.
<ul style="list-style-type: none"> • The advantages and disadvantages of chain drives over v-belt and gear drives are listed. <p><i>Range:</i> <i>Factors determining selection of chain and chain drive types; application of chain-types; advantages and disadvantages of chain drives when compared with v-belt and gear drives.</i></p>	<ul style="list-style-type: none"> • List the advantages and disadvantages of chain drives in comparison to v-belt and gear drives.
<ul style="list-style-type: none"> • Chain components are identified from given drawings using correct terms. <p><i>Range:</i></p> <ul style="list-style-type: none"> • <i>Chain terms include drive and driven sprockets, drive motor, idlers and tensioners, roller chain terms (bearing pins, outer plates, inner plates bushes, rollers), chain pitch, pin diameter, roller diameter, link plates and thickness, chain width.</i> • <i>Drive terms and functions of components are explained.</i> 	<ul style="list-style-type: none"> • Identify chain components from given drawings using correct terms
<ul style="list-style-type: none"> • Chain drive terms are used to explain functions of components. 	<ul style="list-style-type: none"> • Explain chain drive terms and the functions of components

<ul style="list-style-type: none"> Common and special chain and sprocket types are named. <p><i>Range:</i></p> <ul style="list-style-type: none"> <i>Common and special chain and sprocket types and their composition are represented by means of a sectional drawing.</i> <i>Sketches may include chain sprockets for chain drives (sprocket-types; sprocket bearings, sprocket alignment) and link-types (precision roller; double-pitch-; silent-; leaf-types)</i> 	<ul style="list-style-type: none"> Name the common and special chain and sprocket types.
<ul style="list-style-type: none"> Chain drive sprocket types for single and multiple chain drives are compared using a simple sectional drawing. 	<ul style="list-style-type: none"> Use a simple sectional drawing to distinguish between chain drive sprocket types for single and multiple chain drives.

ASSESSMENT TASKS OR ACTIVITIES

<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations
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SUBJECT OUTCOME

5.2 Explain correct safety procedures and care when working with chain drives.

Range:

Safety procedures include excerpts from the Driven Machinery Regulations. Safety measures include the impact on human beings, machines, equipment, materials and the environment.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Worksite health and safety practices when working with chain drives are explained. 	<ul style="list-style-type: none"> Explain worksite health and safety practices when working with chain drives.
<ul style="list-style-type: none"> Good housekeeping is explained. 	<ul style="list-style-type: none"> Explain good housekeeping.
<p>The safety precautions to take when working with chain drives are explained.</p> <p><i>Range:</i></p> <ul style="list-style-type: none"> <i>Chain drive safety includes the application of personal protective equipment, safety precautions for mounting, removal, disassembly, start-up procedures, protective guards and other best practice procedures.</i> <i>Chains are included with transmission belts in the Driven Machinery Regulations.</i> 	<ul style="list-style-type: none"> Explain the safety precautions to take when working with chain drives.
<ul style="list-style-type: none"> Appropriate personal protective equipment is identified and its importance explained. 	<ul style="list-style-type: none"> Identify appropriate personal protective equipment and explain its importance.
<ul style="list-style-type: none"> The importance of a clean working area and the need for effective cleaning equipment, materials and machines is explained. 	<ul style="list-style-type: none"> Explain the importance of a clean working area and the need for effective cleaning equipment, materials and machines.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
5.3 Plan and prepare for chain drive maintenance.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The job card, documentation and engineering drawings, are obtained, read and interpreted. 	<ul style="list-style-type: none"> • Read and interpret the job card, obtain documentation and interpret engineering drawings.
<ul style="list-style-type: none"> • Personnel requirements are identified and maintenance procedures scheduled. 	<ul style="list-style-type: none"> • Identify personnel requirements and schedule maintenance procedures.
<ul style="list-style-type: none"> • The appropriate tools and equipment are selected. 	<ul style="list-style-type: none"> • Select appropriate tools and equipment.
<ul style="list-style-type: none"> • The complete assembly is cleaned and inspected. 	<ul style="list-style-type: none"> • Clean and inspect the complete assembly.
<ul style="list-style-type: none"> • Potential areas of defectiveness and wear are listed. 	<ul style="list-style-type: none"> • List potential areas of defectiveness and wear.
<ul style="list-style-type: none"> • The equipment is isolated electrically from other energy sources. 	<ul style="list-style-type: none"> • Isolate equipment electrically from other energy sources.
<ul style="list-style-type: none"> • The equipment is isolated mechanically from other energy sources. 	<ul style="list-style-type: none"> • Isolate equipment mechanically from other energy sources.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
5.4 Dismantle and assemble chain drives	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<i>Range:</i> <ul style="list-style-type: none"> • This task may be simulated with a typical workshop chain drive station. • A simplex chain may be used for this purpose. • Alignment method should be basic - with the aid of an engineering square, feather gauge and feelers (clock gauge is optional) • Maintenance includes: Checking of chain sizes and lengths; alignment and tensioning; installation of chain drives; elimination and accommodation of chain deflection and/or sag; elongation due to wear. 	
<ul style="list-style-type: none"> • The chain drive is disassembled. 	<ul style="list-style-type: none"> • Disassemble the chain drive.
<ul style="list-style-type: none"> • The chain drive assembly components are identified. 	<ul style="list-style-type: none"> • Identify chain drive assembly components.

• The chain drive assembly is removed	• Remove the chain drive assembly
• The parts are inspected for non-conformances.	• Inspect parts for non-conformances.
• The parts are cleaned.	• Clean the parts.
• The chain drive assembly and components are assembled.	• Assemble the chain drive assembly and components.
• The chain lubrication device or mechanism is cleaned and overhauled <i>Range</i> • <i>Chain lubrication methods: manual, drip-, bath-, disc-, and oil-stream lubrication</i>	• Clean and overhaul chain lubrication device or mechanism
• Appropriate safety practices are applied during the process.	• Apply appropriate safety practices during the process.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
5.5 Perform quality checks and job completion procedures	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
• Quality checks are conducted.	• Conduct quality checks.
• The equipment and tools are cleaned and maintained.	• Clean and maintain equipment and tools.
• Defective tools and equipment are reported and discard procedures or repair facilitated.	• Report on defective tools and equipment and facilitate discard procedures or repair.
• The equipment and tools are stored in an authorised place.	• Store equipment and tools in an authorised place.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

Topic 6: Gear Drives

SUBJECT OUTCOME
6.1 Demonstrate an understanding of gear drives
<i>Range:</i> <ul style="list-style-type: none"> • <i>Gear drives include rack and pinion, spur-, bevel-, worm and worm-wheel-, helical and double helical-, hypoid-types.</i>

<ul style="list-style-type: none"> • <i>Gear assemblies include simple and compound gear trains.</i> • <i>Terminology includes drive and driven gears, input and output shafts, gear housing/casing, lubrication, bearings.</i> 	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The application and functions of gear drives are explained using appropriate terminology. 	<ul style="list-style-type: none"> • Explain the application and functions of gear drives using appropriate terminology.
<ul style="list-style-type: none"> • The advantages and disadvantages of gear drives over v-belt and chain drives are listed. 	<ul style="list-style-type: none"> • List the advantages and disadvantages of gear drives in comparison to with v-belt and chain drives.
<ul style="list-style-type: none"> • The differences between cycloid- and involute-generated gear teeth profiles are distinguished using line drawings. 	<ul style="list-style-type: none"> • Use line drawings to distinguish between cycloid- and involute-generated gear teeth profiles.
<ul style="list-style-type: none"> • The principle of velocity ratio and mechanical advantage in gear assemblies are explained. 	<ul style="list-style-type: none"> • Explain the principle of velocity ratio and mechanical advantage in gear assemblies.
<ul style="list-style-type: none"> • The purpose of intermediate gears is explained. 	<ul style="list-style-type: none"> • Explain the purpose of intermediate gears.
<ul style="list-style-type: none"> • The factors which determine the correct mesh of gear teeth are listed. 	<ul style="list-style-type: none"> • List the factors which determine the correct mesh of gear teeth.
<ul style="list-style-type: none"> • The differences between simple and compound gear trains are explained. 	<ul style="list-style-type: none"> • Distinguish between simple and compound gear trains.
<ul style="list-style-type: none"> • The application of reduction gearboxes is explained. <i>Range:</i> <i>Reduction gearboxes include: single and double reduction gearboxes; worm and worm-wheel reduction gearboxes.</i> 	<ul style="list-style-type: none"> • Explain the application of reduction gearboxes.
<ul style="list-style-type: none"> • The main components of a typical reduction gearbox are identified, named and labelled. <i>Range:</i> <i>Terminology includes drive and driven gears, input and output shafts, gear housing/casing, lubrication, bearings.</i> 	<ul style="list-style-type: none"> • Identify, name and label the main components of a typical reduction gearbox.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
6.2 Explain correct safety procedures and care when working with gear drives.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Worksite health and safety practices when working with gear drives are explained. <i>Range:</i> <i>Safety procedures include excerpts from the Driven Machinery Regulations. Safety measures include the impact on human beings, machines, equipment, materials and the environment.</i> 	<ul style="list-style-type: none"> • Explain worksite health and safety practices when working with gear drives.

<ul style="list-style-type: none"> • Good housekeeping is explained. 	<ul style="list-style-type: none"> • Explain good housekeeping.
<p>The safety precautions for working with gear drives are explained.</p> <p>Range:</p> <p><i>Gear drive safety includes the application of personal protective equipment, safety precautions for mounting, removal, disassembly, start-up procedures, protective guards and other best practice procedures.</i></p>	<ul style="list-style-type: none"> • Explain the safety precautions for working with gear drives.
<ul style="list-style-type: none"> • Appropriate personal protective equipment is identified and its importance explained. 	<ul style="list-style-type: none"> • Identify appropriate personal protective equipment and explain its importance.
<ul style="list-style-type: none"> • The importance of a clean working area and the need for effective cleaning equipment, materials and machines are explained. 	<ul style="list-style-type: none"> • Explain the importance of a clean working area and the need for effective cleaning equipment, materials and machines.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME

6.3 Plan and prepare for gear drive maintenance.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The job card is read and interpreted, documentation is obtained and the engineering drawings interpreted. 	<ul style="list-style-type: none"> • Read and interpret the job card, obtain documentation and interpret engineering drawings.
<ul style="list-style-type: none"> • Personnel requirements are identified and maintenance procedures scheduled. 	<ul style="list-style-type: none"> • Identify personnel requirements and schedule maintenance procedures.
<ul style="list-style-type: none"> • The appropriate tools and equipment are selected. 	<ul style="list-style-type: none"> • Select appropriate tools and equipment.
<ul style="list-style-type: none"> • The complete assembly is cleaned and inspected. 	<ul style="list-style-type: none"> • Clean and inspect the complete assembly.
<ul style="list-style-type: none"> • Potential areas of defectiveness and wear are listed. 	<ul style="list-style-type: none"> • List the potential areas of defectiveness and wear.
<ul style="list-style-type: none"> • The equipment is isolated electrically from other energy sources. 	<ul style="list-style-type: none"> • Isolate equipment electrically from other energy sources.
<ul style="list-style-type: none"> • The equipment is isolated mechanically from other energy sources. 	<ul style="list-style-type: none"> • Isolate equipment mechanically from other energy sources.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME	
6.4 Dismantle and assemble a gear drive	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<i>Range:</i> <ul style="list-style-type: none"> • This task may be simulated with a typical workshop chain drive station. • A typical worm reduction unit may be used for this purpose. 	
<ul style="list-style-type: none"> • The gear drive is disassembled. 	<ul style="list-style-type: none"> • Disassemble the gear drive.
<ul style="list-style-type: none"> • The gear drive assembly components are identified. 	<ul style="list-style-type: none"> • Identify gear drive assembly components.
<ul style="list-style-type: none"> • The gear drive assembly is removed 	<ul style="list-style-type: none"> • Remove the gear drive assembly
<ul style="list-style-type: none"> • The parts are inspected for non-conformances. 	<ul style="list-style-type: none"> • Inspect parts for non-conformances.
<ul style="list-style-type: none"> • The parts are cleaned. 	<ul style="list-style-type: none"> • Clean the parts.
<ul style="list-style-type: none"> • The gear drive assembly and components are assembled. 	<ul style="list-style-type: none"> • Assemble the gear drive assembly and components.
<ul style="list-style-type: none"> • The gear lubricant is cleaned and replenished. 	<ul style="list-style-type: none"> • Clean and replenish gear lubricant.
<ul style="list-style-type: none"> • Appropriate safety practices are applied during the process. 	<ul style="list-style-type: none"> • Apply appropriate safety practices during the process.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
6.5 Perform quality checks and job completion procedures	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Quality checks are conducted. 	<ul style="list-style-type: none"> • Conduct quality checks.
<ul style="list-style-type: none"> • The equipment and tools are cleaned and maintained. 	<ul style="list-style-type: none"> • Clean and maintain equipment and tools.
<ul style="list-style-type: none"> • Defective tools and equipment are reported and discard procedures or repair facilitated. 	<ul style="list-style-type: none"> • Report on defective tools and equipment and facilitate discard procedures or repair.
<ul style="list-style-type: none"> • The equipment and tools are stored in an authorised place. 	<ul style="list-style-type: none"> • Store equipment and tools in an authorised place.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

Topic 7: Pipes and Pipe fittings

SUBJECT OUTCOME	
7.1 Demonstrate an understanding of pipes and pipe fittings	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The correct terminology associated with pipe sizing is used. <p><i>Range:</i></p> <ul style="list-style-type: none"> <i>Pipe sizing terminology includes pipe length, inside diameter (ID), outside diameter (OD), wall thickness, nominal bore (NB), reference of the term “scheduled pipe”, reading of a pipe specification chart, pipe-spool.</i> 	<ul style="list-style-type: none"> Use terminology associated with pipe sizing.
<ul style="list-style-type: none"> Various pipe fittings are identified and their application is explained. <p><i>Range:</i></p> <p><i>Pipe fittings include elbow, tee, cross, socket, barrel nipple, plug, cap, reducing socket.</i></p>	<ul style="list-style-type: none"> Identify various pipe fittings and explain where they are used
<ul style="list-style-type: none"> Various joining methods for steel water pipes and plastic water pipes are explained. <p><i>Range:</i></p> <p><i>Joining methods for steel water pipes and plastic water pipes include screw-threaded, welded, flanged, bell- and spigot, butt- and strap joint and threaded union-types.</i></p>	<ul style="list-style-type: none"> Explain various joining methods for steel water pipes and plastic water pipes
<ul style="list-style-type: none"> A comparison is made between the two different types of plastic piping <p><i>Range:</i></p> <p><i>Thermoplastic piping; Thermosetting plastic piping</i></p>	<ul style="list-style-type: none"> Distinguish two different types of plastic piping
<ul style="list-style-type: none"> The advantages and disadvantages of plastic piping are explained. 	<ul style="list-style-type: none"> Explain the advantages and disadvantages of plastic piping
<ul style="list-style-type: none"> The application of pipe cutters and reamers is explained. <p><i>Range:</i></p> <p><i>Pipe-fitting tools include pipe-cutter and pipe reamer</i></p>	<ul style="list-style-type: none"> Describe briefly how pipe cutters and reamers are used
<ul style="list-style-type: none"> Materials used to seal threaded pipes are described 	<ul style="list-style-type: none"> Describe materials used to seal threaded pipes
<ul style="list-style-type: none"> The joining methods for pipe-lines are described and explained. <p><i>Range:</i></p> <p><i>Joining methods for pipe-lines include socket fusion, butt-welding, compression jointing and sealing with the aid of o-ring seals.</i></p>	<ul style="list-style-type: none"> Describe and explain the joining methods for pipe-lines
<ul style="list-style-type: none"> The methods used to accommodate expansion in pipe-lines are described. <p><i>Range:</i></p> <p><i>Methods used to accommodate expansion in pipe-lines include expansion diaphragm, pipe suspension on rollers, telescopic expansion joint, corrugated expansion joint and the application of expansion bends and loops (creased bend-, full loop-, horseshoe- and expansion-types).</i></p>	<ul style="list-style-type: none"> Describe the methods used to accommodate expansion in pipe-lines.
<ul style="list-style-type: none"> Reasons are provided for the failure of flanged joints. 	<ul style="list-style-type: none"> Provide reasons for the failure of flanged joints.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
7.2 Explain correct safety procedures and care when working with pipes and pipe fittings.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Worksite health and safety practices when working with pipes and pipe fittings are explained. <i>Range:</i> <i>Safety procedures include excerpts from the Driven Machinery Regulations. Safety measures include the impact on human beings, machines, equipment, materials and the environment.</i> 	<ul style="list-style-type: none"> • Explain worksite health and safety practices when working with pipes and pipe fittings.
<ul style="list-style-type: none"> • Good housekeeping is explained. 	<ul style="list-style-type: none"> • Explain good housekeeping.
<ul style="list-style-type: none"> • Safety precautions to take when working with pipes and pipe-fittings are explained. <i>Range:</i> <i>Pipe-fitting safety includes the application of personal protective equipment, safety precautions for mounting, removal, disassembly and other best practice procedures.</i> 	<ul style="list-style-type: none"> • Explain safety precautions to take when working with pipes and pipe-fittings.
<ul style="list-style-type: none"> • Appropriate personal protective equipment is identified and its importance explained. 	<ul style="list-style-type: none"> • Identify appropriate personal protective equipment and explain its importance.
<ul style="list-style-type: none"> • The importance of a clean working area and the need for effective cleaning equipment, materials and machines are explained. 	<ul style="list-style-type: none"> • Explain the importance of a clean working area and the need for effective cleaning equipment, materials and machines.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
7.3 Plan and prepare for pipe/pipe-line maintenance.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES

<ul style="list-style-type: none"> • A job card is read and interpreted, documentation is obtained and engineering drawings are interpreted. 	<ul style="list-style-type: none"> • Read and interpret a job card, obtain documentation and interpret engineering drawings.
<ul style="list-style-type: none"> • Personnel requirements are identified and maintenance procedures scheduled (clearance acceptance/permit) 	<ul style="list-style-type: none"> • Identify personnel requirements and schedule maintenance procedures (clearance acceptance/permit)
<ul style="list-style-type: none"> • The appropriate tools and equipment are selected. 	<ul style="list-style-type: none"> • Select appropriate tools and equipment.
<ul style="list-style-type: none"> • The complete assembly is cleaned and inspected. 	<ul style="list-style-type: none"> • Clean and inspect the complete assembly.
<ul style="list-style-type: none"> • The potential areas of hazard are listed. 	<ul style="list-style-type: none"> • List the potential areas of hazard.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME

7.4 Dismantle and assemble pipes and pipe-lines

Range:

- This task may be simulated within a pipe installation station in the training workshop.
- This pipe installation may be connected to a pump system for this purpose.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The pipe/pipe-line is disassembled. 	<ul style="list-style-type: none"> • Disassemble the pipe/pipe-line.
<ul style="list-style-type: none"> • The pipe/pipe-line assembly components are identified. 	<ul style="list-style-type: none"> • Identify pipe/pipe-line assembly components.
<ul style="list-style-type: none"> • The pipe/pipe-line assembly is removed 	<ul style="list-style-type: none"> • Remove the pipe/pipe-line assembly
<ul style="list-style-type: none"> • The parts are inspected for non-conformances. 	<ul style="list-style-type: none"> • Inspect parts for non-conformances.
<ul style="list-style-type: none"> • The parts are cleaned. 	<ul style="list-style-type: none"> • Clean the parts.
<ul style="list-style-type: none"> • The pipe/pipe-line assembly and components are assembled. 	<ul style="list-style-type: none"> • Assemble the pipe/pipe-line assembly and components.
<ul style="list-style-type: none"> • The appropriate safety practices are applied during the process. 	<ul style="list-style-type: none"> • Apply appropriate safety practices during the process.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME	
7.5 Perform quality checks and job completion procedures	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Quality checks are conducted. 	<ul style="list-style-type: none"> Conduct quality checks.
<ul style="list-style-type: none"> The replacement parts are measured and tested and their performance evaluated. 	<ul style="list-style-type: none"> Measure and test replacement parts and evaluate performance.
<ul style="list-style-type: none"> The equipment and tools are cleaned and maintained. 	<ul style="list-style-type: none"> Clean and maintain equipment and tools.
<ul style="list-style-type: none"> A report is made on defective tools and equipment and their discard or repair is facilitated. 	<ul style="list-style-type: none"> Report on defective tools and equipment and facilitate discard procedures or repair.
<ul style="list-style-type: none"> The equipment and tools are stored in an authorised place. 	<ul style="list-style-type: none"> Store equipment and tools in an authorised place.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

Topic 8: Valves

SUBJECT OUTCOME	
8.1 Demonstrate an understanding of valves	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The function of a valve and its working principles are explained. 	<ul style="list-style-type: none"> Explain the function of a valve and its working principle.
<ul style="list-style-type: none"> Valves are identified, named and labelled. <i>Range: Includes valves used in water, gas, steam and high air-pressure installations</i> 	<ul style="list-style-type: none"> Identify, name and label valves.
<ul style="list-style-type: none"> The working principles of the various types of valves are described. <i>Range: Typical valves for this level include: gate valve, diaphragm valve, safety valves for gas and steam pipelines, relief valve for liquids, non-return valve, butterfly valve, ball valve, foot valve.</i> 	<ul style="list-style-type: none"> Describe the working principles of the various types of valves.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

SUBJECT OUTCOME	
8.2 Explain correct safety procedures and care when working with valves.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Worksite health and safety practices when working with valves are explained. <i>Range:</i> <i>Safety procedures include excerpts from the Driven Machinery Regulations. Safety measures include the impact on human beings, machines, equipment, materials and the environment.</i> 	<ul style="list-style-type: none"> Explain worksite health and safety practices when working with valves.
<ul style="list-style-type: none"> Good housekeeping is explained. 	<ul style="list-style-type: none"> Explain good housekeeping.
<ul style="list-style-type: none"> The safety precautions to take when working with valves are explained. <i>Range:</i> <i>Valve-fitting safety includes the application of personal protective equipment, safety precautions for mounting, removal, disassembly and other best practice procedures.</i> 	<ul style="list-style-type: none"> Explain the safety precautions to take when working with valves.
<ul style="list-style-type: none"> The importance of a clean working area and the need for effective cleaning equipment, materials and machines is explained. 	<ul style="list-style-type: none"> Explain the importance of a clean working area and the need for effective cleaning equipment, materials and machines.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

SUBJECT OUTCOME	
8.3 Plan and prepare for valve maintenance.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Job card is read and interpreted, documentation is obtained, engineering drawings are interpreted. 	<ul style="list-style-type: none"> Read and interpret job card, obtain documentation and interpret engineering drawings.
<ul style="list-style-type: none"> Personnel requirements are identified and maintenance procedures scheduled (clearance acceptance/permit) 	<ul style="list-style-type: none"> Identify personnel requirements and schedule maintenance procedures (clearance acceptance/permit)
<ul style="list-style-type: none"> The appropriate tools and equipment are selected. 	<ul style="list-style-type: none"> Select appropriate tools and equipment.
<ul style="list-style-type: none"> The complete assembly is cleaned and inspected. 	<ul style="list-style-type: none"> Clean and inspect the complete assembly.
<ul style="list-style-type: none"> The potential areas of hazard are listed. 	<ul style="list-style-type: none"> List the potential areas of hazard.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
8.4 Dismantle and assemble valves	
<p><i>Range:</i></p> <ul style="list-style-type: none"> • This task may be simulated within a pipe installation station in the training workshop. • The pipe installation may be connected to a pump system for this purpose. <p><i>Recommended: After assembly and fitting, lecturers are encouraged to use the valve/s in order to demonstrate the shut-off and by-pass of fluid flow with the aid of the valves used in the task</i></p>	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The valve is disassembled. 	<ul style="list-style-type: none"> • Disassemble the valve.
<ul style="list-style-type: none"> • Valve-assembly components are identified. 	<ul style="list-style-type: none"> • Identify valve-assembly components.
<ul style="list-style-type: none"> • The valve-assembly is removed 	<ul style="list-style-type: none"> • Remove the valve-assembly
<ul style="list-style-type: none"> • The parts are inspected for non-conformances. 	<ul style="list-style-type: none"> • Inspect parts for non-conformances.
<ul style="list-style-type: none"> • The parts are cleaned. 	<ul style="list-style-type: none"> • Clean the parts.
<ul style="list-style-type: none"> • The pipe/pipe-line assembly and components are assembled. 	<ul style="list-style-type: none"> • Assemble the pipe/pipe-line assembly and components.
<ul style="list-style-type: none"> • The appropriate safety practices are applied during the process. 	<ul style="list-style-type: none"> • Apply appropriate safety practices during the process.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
8.5 Perform quality checks and job completion procedures	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Quality checks are conducted. 	<ul style="list-style-type: none"> • Conduct quality checks.
<ul style="list-style-type: none"> • The replacement parts are measured and tested and performance evaluated. 	<ul style="list-style-type: none"> • Measure and test replacement parts and evaluate performance.
<ul style="list-style-type: none"> • Information on the completed job is accurately recorded. 	<ul style="list-style-type: none"> • Accurately record information on completed job.
<ul style="list-style-type: none"> • The equipment and tools are cleaned and maintained. 	<ul style="list-style-type: none"> • Clean and maintain equipment and tools.

<ul style="list-style-type: none"> • A report is made on defective tools and equipment and the discard and repair procedures facilitated. 	<ul style="list-style-type: none"> • Report on defective tools and equipment and facilitate discard procedures or repair.
<ul style="list-style-type: none"> • The equipment and tools are stored in an authorised place. 	<ul style="list-style-type: none"> • Store equipment and tools in an authorised place.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

Topic 9: Centre Lathe

SUBJECT OUTCOME	
9.1. Follow safety rules and maintain safety precautions	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Appropriate clothing is worn. 	<ul style="list-style-type: none"> • Wear and use appropriate clothing
<ul style="list-style-type: none"> • Placement of machine guards is checked. 	<ul style="list-style-type: none"> • Check the placement of the machine guards
<ul style="list-style-type: none"> • The work area and adequate surrounding space is cleared. 	<ul style="list-style-type: none"> • Clear the work area to allow adequate space
<ul style="list-style-type: none"> • The power to the lathe machine is switched off when loading and unloading a work piece, when taking measurements and during cleaning 	<ul style="list-style-type: none"> • Check that the lathe machine is switched off when loading and unloading a work piece, when taking measurements and during cleaning
<ul style="list-style-type: none"> • A guard or shield is used to deflect chips. 	<ul style="list-style-type: none"> • Use a guard or shield to deflect chips
<ul style="list-style-type: none"> • The work area is clean and free of chips, spills and fluids. 	<ul style="list-style-type: none"> • Clean the work area of chips, spills and fluids

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
9.2. Prepare Operation Sheet	
<i>Range:</i> <ul style="list-style-type: none"> • <i>HM cutting to be introduced with use of minimum depth of cut 1.0 (nose radius of cutting tool)</i> • <i>Max feed for roughing and depth to be applied for HM cutting tool</i> • <i>Finishing cut must be minimum nose radius</i> • <i>Feed in finishing cut must be set according to surface specification</i> 	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The proper machining sequence is identified. 	<ul style="list-style-type: none"> • Identify the proper machining sequence.
<ul style="list-style-type: none"> • The work piece material is identified. 	<ul style="list-style-type: none"> • Identify the work piece material.

• The work piece diameter is determined.	• Determine the work piece diameter.
• The correct type of cutting tool is selected.	• Select the correct type of cutting tool.
• Cutting speeds are chosen as per the specifications.	• Choose cutting speeds as per specifications.
• The RPM is calculated according to roughing/finishing.	• Calculate the RPM according to roughing/finishing.
• The depth of cut is calculated according to roughing /finishing.	• Calculate the depth of cut according to roughing/finishing.
• The feed rate is calculated according to roughing/ finishing.	• Calculate the feed rate cut according to roughing/finishing.
• Turning is within tolerance as per the drawing ± 0.1	• Turn within tolerance as per the drawing ± 0.1 .

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME

9.3. Prepare for work activity

ASSESSMENT STANDARDS	LEARNING OUTCOMES
• Tools and equipment required for lathe operation are selected.	• Select tools and equipment required for the lathe operation.
• The working condition of tools and equipment is checked.	• Check whether tools and equipment are in good working condition.
• The lathe is maintained, oiled and lubricated according to specifications.	• Maintain oil and lubricate the lathe according to specifications.
• Competence in the use of handles, gearbox and spindle settings is achieved.	• Achieve competence in the use of handles, gearbox and spindle settings.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME

9.4. Set the lathe.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
• All tooling requirements are set out for the task.	• Set out all tooling requirements for the task.
• The selected cutter is fitted in the tool post and the cutter height is adjusted	• Fit the selected cutter in the tool post and adjust the cutter height.

<ul style="list-style-type: none"> The graduated sleeve of the cross-slide is set to zero. 	<ul style="list-style-type: none"> Set the graduated sleeve of the cross-slide to zero.
<ul style="list-style-type: none"> The compound slide graduated dial is set to zero. 	<ul style="list-style-type: none"> Set the compound slide to zero.
<ul style="list-style-type: none"> The carriage is positioned for cutting. 	<ul style="list-style-type: none"> Position the carriage for cutting.
<ul style="list-style-type: none"> The work piece is securely clamped and the set-up checked. 	<ul style="list-style-type: none"> Clamp the work pieces securely and check the set-up.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME

9.5. Perform turning operations

Range:

- Turning task should include taper turning with the use of the compound slide. The task should be simple and may include grooving and parting.
- Tolerance is $\pm 0,1$ mm at this level.
- All work is performed using a 3-jaw chuck.

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The calculated RPM setting is adjusted. 	<ul style="list-style-type: none"> Adjust to the calculated RPM setting.
<ul style="list-style-type: none"> The feed rate is adjusted. 	<ul style="list-style-type: none"> Adjust the feed rate.
<ul style="list-style-type: none"> The cutter is set against the work piece and the cutting depth is adjusted. 	<ul style="list-style-type: none"> Set the cutter against the work piece and adjust the cutting depth.
<ul style="list-style-type: none"> Automatic or manual feed is engaged. 	<ul style="list-style-type: none"> Engage automatic or manual feed.
<ul style="list-style-type: none"> The cutter is flooded with coolant when using the HSS tool. 	<ul style="list-style-type: none"> Flood the cutter with coolant when using the HSS tool.
<ul style="list-style-type: none"> Facing, longitudinal turning and grooving operations are performed. 	<ul style="list-style-type: none"> Perform facing, longitudinal turning, and grooving operations (knurling is optional).
<ul style="list-style-type: none"> The workpiece is turned to tolerance of ± 0.1 mm. 	<ul style="list-style-type: none"> Turn to tolerances of ± 0.1 mm.
<ul style="list-style-type: none"> The machined component is removed on completion of the turning process. 	<ul style="list-style-type: none"> Remove the machined component on completion of the turning process.

ASSESSMENT TASKS OR ACTIVITIES

- Observation
- Assignments or tasks
- Projects
- Practical exercises
- Demonstrations

SUBJECT OUTCOME	
9.6. Apply quality checks on machined component.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Correct tools and equipment for quality checking are selected. 	<ul style="list-style-type: none"> • Select correct tools and equipment for quality checking.
<ul style="list-style-type: none"> • Values for checking are identified according to specifications 	<ul style="list-style-type: none"> • Identify values for checking.
<ul style="list-style-type: none"> • The cutting surface finish is checked according to specifications 	<ul style="list-style-type: none"> • Check the cutting surface finish for correctness according to specifications.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
9.7 Recognise and report problems, changes and/or malfunctions while operating	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Conformance of component to specifications is documented. 	<ul style="list-style-type: none"> • Recognise and report problems.
<ul style="list-style-type: none"> • Conformance of component to specifications is documented. 	<ul style="list-style-type: none"> • Recognise and report changes.
<ul style="list-style-type: none"> • Conformance of component to specifications is documented. 	<ul style="list-style-type: none"> • Recognise and report malfunctions.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

Topic 10: Milling Machine

SUBJECT OUTCOME	
10.1. Follow safety rules and maintain safety precautions	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Appropriate clothing is worn. 	<ul style="list-style-type: none"> • Wear and use appropriate clothing
<ul style="list-style-type: none"> • The placement of machine guards is checked. 	<ul style="list-style-type: none"> • Ensure the machine guards are in place
<ul style="list-style-type: none"> • The work area is free and spacious. 	<ul style="list-style-type: none"> • Ensure the work area is free and spacious
<ul style="list-style-type: none"> • Gloves/hand protection are used when mounting milling cutters. 	<ul style="list-style-type: none"> • Use gloves/hand protection when mounting milling cutters.

<ul style="list-style-type: none"> The milling machine is switched off when a work piece is loaded or unloaded, when measurements are taken and during cleaning. 	<ul style="list-style-type: none"> Ensure the milling machine is switched off when loading and unloading a work piece, when taking measurements and during cleaning.
<ul style="list-style-type: none"> A guard or shield is used to deflect chips 	<ul style="list-style-type: none"> Use a guard or shield to deflect chips
<ul style="list-style-type: none"> The work area is clean and free of chips, spills and fluids. 	<ul style="list-style-type: none"> Ensure the work area is clean and free of chips, spills and fluids.

ASSESSMENT TASKS OR ACTIVITIES

<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations
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SUBJECT OUTCOME

10.2. Prepare an operation sheet

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The proper machining sequence is identified. 	<ul style="list-style-type: none"> Identify the proper machining sequence
<ul style="list-style-type: none"> The type of cutting tool to be used is identified. 	<ul style="list-style-type: none"> Identify the type of cutting tool to be used.
<ul style="list-style-type: none"> The cutting speed is identified as per the specifications. 	<ul style="list-style-type: none"> Identify the cutting speed as per the specifications
<ul style="list-style-type: none"> The RPM is calculated according to roughing/finishing. 	<ul style="list-style-type: none"> Calculate the RPM according to roughing/finishing
<ul style="list-style-type: none"> The depth of cut is calculated according to roughing/finishing. 	<ul style="list-style-type: none"> Calculate the depth of cut according to roughing/finishing
<ul style="list-style-type: none"> The feed rate cut is calculated according to roughing/finishing. 	<ul style="list-style-type: none"> Calculate the feed rate cut according to roughing/finishing
<ul style="list-style-type: none"> The dividing head settings are determined for rapid indexing. 	<ul style="list-style-type: none"> Determine the dividing head settings for rapid indexing
<ul style="list-style-type: none"> Appropriate working tolerances are specified as per drawing ± 0.1 mm. 	<ul style="list-style-type: none"> Specify an appropriate working tolerance as per the drawing ± 0.1 mm.

ASSESSMENT TASKS OR ACTIVITIES

<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations
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SUBJECT OUTCOME

10.3. Prepare for work activity

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The machine is prepared for operation including lubrication and routine maintenance. 	<ul style="list-style-type: none"> Prepare the machine for operation, including lubrication and routine maintenance.
<ul style="list-style-type: none"> Pre-operational checks of the lathe are done 	<ul style="list-style-type: none"> Conduct pre-operational checks of the lathe.

<ul style="list-style-type: none"> • Appropriate required materials and tools are available. 	<ul style="list-style-type: none"> • Ensure that appropriate materials and tools required are available.
<ul style="list-style-type: none"> • Cutting fluid is available. 	<ul style="list-style-type: none"> • Ensure that cutting fluid is available.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME	
10.4 Set the milling machine	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The appropriate cutting tool is mounted <i>Range: HSS – end-milling cutter, slot-drill / slotting cutter</i> 	<ul style="list-style-type: none"> • Mount the appropriate cutting tool.
<ul style="list-style-type: none"> • The clamping arrangement is set 	<ul style="list-style-type: none"> • Set the clamping arrangement.
<ul style="list-style-type: none"> • The table X and Y axes are perpendicular to the spindle axis. 	<ul style="list-style-type: none"> • Set the table X and Y axes perpendicular to the spindle axis.
<ul style="list-style-type: none"> • The fixed jaw of the vice is parallel to the X axis. 	<ul style="list-style-type: none"> • Set the fixed jaw of the vice is parallel to the X axis
<ul style="list-style-type: none"> • The work piece is mounted. 	<ul style="list-style-type: none"> • Mount the work piece.
<ul style="list-style-type: none"> • Cutting speeds and feeds are selected and set according to the operation sheet. 	<ul style="list-style-type: none"> • Select and set cutting speeds and feeds according to the operation sheet.
<ul style="list-style-type: none"> • The work piece is mounted correctly 	<ul style="list-style-type: none"> • Mount the work piece.
<ul style="list-style-type: none"> • The dividing head is adjusted for direct indexing. <i>Range: The milling task is limited to the rapid indexing method.</i> 	<ul style="list-style-type: none"> • Prepare and set up the dividing head for rapid indexing

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> • Observation • Assignments or tasks • Projects • Practical exercises • Demonstrations

SUBJECT OUTCOME
10.5 Perform milling operations
<p><i>Range:</i></p> <ul style="list-style-type: none"> • Milling task should include the production of flats (quadrangular/hexagonal) with the use of the rapid indexing method and a slotting task. • Tolerance is $\pm 0,1$ mm at this level. • Ensure the “clocking” of the vice for a parallel slotting process (parallel/perpendicular to all reference faces)

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The cutter is positioned and cutting depth and width is set 	<ul style="list-style-type: none"> Set and position the cutter and set the cutting depth and width.
<ul style="list-style-type: none"> The graduated dials are set to zero. 	<ul style="list-style-type: none"> Set graduated dials to zero.
<ul style="list-style-type: none"> The dividing head is adjusted according to the number of sides to be cut 	<ul style="list-style-type: none"> Adjust the dividing head according to the number of sides to be cut.
<ul style="list-style-type: none"> The milling machine is monitored while in operation 	<ul style="list-style-type: none"> Monitor milling machine while in operation.
<ul style="list-style-type: none"> The speeds and feeds are adjusted 	<ul style="list-style-type: none"> Adjust speeds and feeds where required.
<ul style="list-style-type: none"> Cutter is flooded with coolant when using the HSS tool. 	<ul style="list-style-type: none"> Flood the cutter with coolant when using the HSS tool.
<ul style="list-style-type: none"> Automatic or manual feed is used 	<ul style="list-style-type: none"> Use automatic or manual feed.
<ul style="list-style-type: none"> Flat and slot mill within a tolerance of ± 0.1 performed 	<ul style="list-style-type: none"> Perform flat, and slot milling within a tolerance of ± 0.1 mm.
<ul style="list-style-type: none"> The head is tightened after each indexing. 	<ul style="list-style-type: none"> Tighten the head after each indexing.
<ul style="list-style-type: none"> The work piece is removed after machining 	<ul style="list-style-type: none"> Remove the work piece after machining.
<ul style="list-style-type: none"> The milling machine is cleaned on completion of the job. 	<ul style="list-style-type: none"> Clean the milling machine after completion of the job.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

SUBJECT OUTCOME	
10.6 Perform quality checks on the machined component.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The correct tools and equipment are selected to perform a quality check. 	<ul style="list-style-type: none"> Select the correct tools and equipment for to perform a quality check.
<ul style="list-style-type: none"> Values are identified for checking. 	<ul style="list-style-type: none"> Identify values for checking.
<ul style="list-style-type: none"> Cutting surface finish is checked. 	<ul style="list-style-type: none"> Check cutting surface finish.
<ul style="list-style-type: none"> The machined component is inspected for conformance to the assessment sheet and drawing specifications. 	<ul style="list-style-type: none"> Inspect the machined component for conformance to the specifications as per assessment sheet and drawing.
<ul style="list-style-type: none"> Conformance of the machined component to specifications is documented. 	<ul style="list-style-type: none"> Document conformance of the machined component to specifications.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

SUBJECT OUTCOME	
10.7 Recognise and report problems, changes and/or malfunctions while operating.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The operating of the milling machine is carefully observed to recognise and report problems, changes and malfunctions. 	<ul style="list-style-type: none"> Recognise and report problems. Recognise and report changes. Recognise and report malfunctions.

ASSESSMENT TASKS OR ACTIVITIES
<ul style="list-style-type: none"> Observation Assignments or tasks Projects Practical exercises Demonstrations

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN FITTING AND TURNING – LEVEL 3

4.1 Integrated summative assessment task (ISAT)

A compulsory component of the external assessment (ESASS) is the **integrated summative assessment task (ISAT)**. The ISAT draws on the students' 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 ISAT may be as follows:

The students are assigned a task at the beginning of the year which they must 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 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.

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