education

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NATIONAL CERTIFICATES (VOCATIONAL)

SUBJECT GUIDELINES

FITTING AND TURNING

NQF LEVEL 2

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FITTING AND TURNING – LEVEL 2

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INTRODUCTION

A. What is Fitting and Turning?

Fitting and Turning is widely applied to engineering technology, such as in machining, maintenance and assembly situations or circumstances. It deals with the various processes involved in making or producing components required in the manufacturing, engineering and technological environment. Fitting and Turning covers land, sea, air and space technology and helps to develop and expand the global economy.

B. Why is Fitting and Turning important in the Engineering and Related Design programme?

Fitting and Turning takes creativity and visionary ideology and makes it a practical reality. Through its application, Fitting and Turning expands new design technology and urges science to create new material compositions.

C. Links between the Fitting and Turning Learning Outcomes and the Critical and Development Outcomes

- THINKING AND PROBLEM-SOLVING SKILLS:
  Identify and solve problems in which responses display that responsible decisions, using critical and creative thinking, have been made.
  - Use different functions and make corrective adjustments in problematic situations.
- INDEPENDENCE AND SELF-MANAGEMENT SKILLS:
  Organise and manage oneself and one's activities responsibly and effectively.
  - Plan sequence of operations based on job instructions and adjust equipment appropriately.
- RESEARCH SKILLS:
  Collect, analyse, organise and critically evaluate information.
  - Examine work piece for machining and non-conformance with specifications.
  - Measure work piece for accuracy.
- LEARNING SKILLS:
  Reflect on and explore a variety of strategies to learn more effectively.
  - Gain experience and knowledge through application of different machining.
- EMPLOYMENT SEEKING SKILLS:
  Explore education and career opportunities.
  - Assure the confidence to succeed by understanding the practical application.
- ENTREPRENEURSHIP:
  Develop entrepreneurial opportunities.
  - Produce a sense of self worth through confidence.

1 DURATION AND TUITION TIME

This is a one-year instructional programme comprising 200 teaching and learning hours. The subject may be offered on a part-time basis provided the student meets all the assessment requirements.

Students with special education needs (LSEN) must be catered for in a way that eliminates barriers to learning.

2 SUBJECT LEVEL FOCUS

The student is able to identify and describe the processes and methods used in Fitting and Turning.

3 ASSESSMENT REQUIREMENTS

3.1 Internal assessment (50 percent)

3.1.1 Theoretical components

The theoretical component forms 40 percent of the internal assessment mark.

Internal assessment of the theoretical component in Fitting and Turning Level 2 takes the form of observation, class questions, group work, informal group competitions with rewards, individual discussions with students, class, topic and semester tests and internal examinations. Lecturers can observe students when marking exercises from the previous day and asking class questions.

Assignments, case studies and tests can be completed at the end of a topic. Tests and internal examinations must form part of the internal assessment.

3.1.2 Practical component

The practical component forms 60 percent of the internal assessment mark.

Practical components include applications and exercises. All practical components must be indicated in a Portfolio of Evidence (PoE).

Internal assessment of the practical component in Fitting and Turning Level 2 takes the form of assignments, practical exercises, case studies and practical examinations in a simulated engineering environment.

Students may complete practical exercises daily. Assignments and case studies can be completed at the end of a topic. Practical examinations can form part of internal practical assessment.

- **Some examples of practical assessments include, but are not limited to:**
  - A. Presentations (lectures, demonstrations, group discussions and activities, practical work, observation, role-play, independent activity, synthesis and evaluation)
  - B. Exhibitions by students
  - C. Visits undertaken by students based on a structured assignment task
  - D. Research
  - E. Task performance in a “Structured Environment”

- **Definition of the term “Structured Environment”**

For the purposes of assessment, “Structured Environment” refers to a simulated workplace or workshop environment. A practicum room should be available at each campus for practical assessment. Activities in the simulated workplace or environment must be documented in a logbook with a clear listing of the competencies to be assessed. The following information must be contained in the logbook:

- Nature of department or environment in which practical component was achieved
- Learning Outcomes
- Activities in the environment with which to achieve the Learning Outcomes
- Time spent on activities
- Signature of lecturer or supervisor and student

For the logbook to be regarded as valid evidence, it must be signed by an officially assigned supervisor.

- **Evidence in practical assessments**

All evidence pertaining to evaluation of practical work must be reflected in the students' Portfolio of Evidence (PoE). The tools and instruments constructed and used to conduct these assessments must be clear from the evidence contained in the Portfolio of Evidence (PoE).

3.1.3 Processing of internal assessment mark for the year

A year mark out of 100 is calculated by adding the marks of the theoretical component (40 percent) and the practical component (60 percent) of the internal continuous assessment (ICASS).

3.1.4 Moderation of internal assessment mark

Internal assessment is subjected to internal and external moderation procedures as set out in the *National Examinations Policy for FET College Programmes*.

3.2 External assessment (50 percent)

A National Examination is conducted annually in October or November by means of a paper(s) set and moderated externally. A practical component will also be assessed.

External assessment details and procedures are set out in the *Assessment Guidelines: Fitting and Turning* (Level 2).

4 WEIGHTED VALUES OF TOPICS

TOPICS	WEIGHTED VALUES
1. Mark Off Basic Engineering Shapes	10
2. Operate and Monitor a Drilling Machine to Produce Simple Components	20
3. Operate and Monitor a Milling Machine to Produce Simple Components	20
4. Operate And Monitor a Surface-grinding Machine to Produce Simple Components	10
5. Operate and Monitor a Lathe to Produce Simple Components	20
6. Perform Basic Welding or Joining of Metals	20
TOTAL	**100**

5 CALCULATION OF FINAL MARK

Internal assessment mark: Student's mark/100 x 50 = a mark out of 50 (a)

Examination mark: Student's mark/100 x 50 = a mark out of 50 (b)

Final mark: (a) + (b) = a mark out of 100

All marks are systematically processed and accurately recorded to be available as hard copy evidence for, amongst others, reporting, moderation and verification purposes.

6 PASS REQUIREMENTS

The student must obtain at least fifty (50) percent in ICASS and fifty (50) percent in the examination.

7 SUBJECT AND LEARNING OUTCOMES

On the completion of Fitting and Turning Level 2, the student should have covered the following topics:

Topic 1: Mark Off Basic Engineering Shapes
Topic 2: Operate and Monitor a Drilling Machine to Produce Simple Components
Topic 3: Operate and Monitor a Milling Machine to Produce Simple Components
Topic 4: Operate and Monitor a Surface-grinding Machine to Produce Simple Components
Topic 5: Operate and Monitor a Lathe to Produce Simple Components
Topic 6: Perform Basic Welding or Joining of Metals

7.1 Topic 1: Mark Off Basic Engineering Shapes

Subject Outcome 1: Plan and prepare materials and equipment for marking off.

Learning Outcomes:

The student should be able to:
- Identify material for the job.
- Identify equipment for marking off.
- Identify marking point.

Subject Outcome 2: Mark off materials using templates.

Learning Outcomes:

The student should be able to:
- Position template to eliminate waste.
- Inspect marking position.
- Place templates on material
- Produce marking.

Subject Outcome 3: Apply quality checks on machined component.

Learning Outcomes:

The student should be able to:
- Select equipment and tools for quality checking.
- Identify things to be checked.
- Write a report.

Subject Outcome 4: Care for and store marking-off equipment.

Learning Outcomes:

The student should be able to:
- Keep the marking-off equipment clean.
- Store equipment in a safe place.
- Use equipment correctly.
- Put equipment in a toolbox.
- Apply oil sparingly to equipment.

Subject Outcome 5: Work safely with due care for self, fellow workers, equipment, materials and the environment.

Learning Outcomes:

The student should be able to:
- Apply worksite health and safety practices.
- Apply good housekeeping.
- Clean work area after the completion of the task.
- Clean equipment, materials and machines after use.
- Wear safety clothes.

Subject Outcome 6: Compile documentation and a feedback report.

Learning Outcomes:

The student should be able to:
- Compile reports in order of completion of tasks.
- Compile feedback reports in order.
- Double-check the reports for correctness.
- Store reports in a safe place.

7.2 Topic 2: Operate and Monitor a Drilling Machine to Produce Simple Components

Subject Outcome 1: Prepare for work activity.

Learning Outcomes:

The student should be able to:

- Select correct tools and equipment for the job.
- Choose materials for the job and calculate revolutions per minute (RPM).
- Indicate time to be taken for the job.

Subject Outcome 2: Set drilling machine.

Learning Outcomes:

The student should be able to:

- Fit selected tooling to drill spindle.
- Calculate required speed and adjust machine speed.
- Clamp work piece in position relative to drill centre line axis.

Subject Outcome 3: Perform drilling operations.

Learning Outcomes:

The student should be able to:

- Start drilling machine.
- Monitor drilling machine.
- Adjust speeds and feeds.

Subject Outcome 4: Apply quality checks on machined component.

Learning Outcomes:

The student should be able to:

- Select correct tools and equipment for quality checking.
- Identify critical points for checking.

Subject Outcome 5: Recognise and report problems, changes and/or malfunctions while operating.

Learning Outcome:

The student should be able to:

- Recognise and report malfunctions.

Subject Outcome 6: Record information on work done.

Learning Outcome:

The student should be able to:

- Select a name for the file.
- Record the information on work done in the file.
- Save the file for reference purposes.

Subject Outcome 7: Work safely with care for self, fellow workers, machines, equipment, materials and environment.

Learning Outcomes:

The student should be able to:

- Apply worksite health and safety practices.
- Apply good housekeeping.
- Clean work area after the completion of the task.
- Clean equipment, materials and machines after use.

7.3 Topic 3: Operate and Monitor a Milling Machine to Produce Simple Components

Subject Outcome 1: Prepare for work activity.

Learning Outcomes:

The student should be able to:

- Select tools and equipment required for the milling operation.
- Check whether tools and equipment are in good working condition.
- Check whether the machine is in good working condition.

Subject Outcome 2: Set milling machine.

Learning Outcomes:

The student should be able to:

- Identify the type of cutting tool.
- Make calculations for the diameter and type of cutter.
- Make calculations on RPM.
- Calculate the depth of cut.
- Calculate the feed rate.
- Calculate indexing
- Set clamping arrangement.
- Set angle plate.
- Position the work piece correctly.
- Check table X and Y axis that is perpendicular to spindle axis.

Subject Outcome 3: Perform milling operations.

Learning Outcomes:

The student should be able to:

- Assess X and Y axis backlash.
- Position cutter and set cutting depth and width.
- Set graduated dials to zero.
- Flood cutter with soluble oil.
- Apply automatic or manual feed.

Subject Outcome 4: Apply quality checks on machined component.

Learning Outcomes:

The student should be able to:

- Check that the machined component surface conforms to the specifications.
- Check that the milled piece conforms to the drawing dimensions.

Subject Outcome 5: Recognise and report problems, changes and/or malfunctions while operating.

Learning Outcomes:

The student should be able to:

- Recognise and report problems.
- Recognise and report changes.
- Recognise malfunctions.

Subject Outcome 6: Record information on work done.

Learning Outcomes:

The student should be able to:

- Select a name for the file.
- Record the information on work done in the file.
- Save the file for reference purposes.

Subject Outcome 7: Work safely with care for self, fellow workers, machines, equipment, materials and environment.

Learning Outcomes:

The student should be able to:

- Apply worksite health and safety practices.
- Clean equipment, materials and machines after use.
- Wear safety clothes.
- Clean work area after completion of the task.
- Apply good housekeeping.

7.4 Topic 4: Operate and Monitor a Surface-grinding Machine to Produce Simple Components

Subject Outcome 1: Prepare for work activity.

Learning Outcomes:

The student should be able to:
- Select tools and equipment required for surface grinding operation.
- Check whether tools and equipment are in good working condition.
- Check whether the machine is in good working condition.
- Practice workshop safety.
- Select correct wheel for grinding operation.
- Determine material type
- Check wheel RPM specification.
- Assess wheel condition.

Subject Outcome 2: Set surface-grinding machine.

Learning Outcomes:

The student should be able to:
- Dress and balance the wheel.
- Adjust height of grinding wheel.
- Position component correctly on surface-grinding table.
- Fix component to grinding table using magnetic table or clamp.
- Adjust automatic feed operation to suit work piece parameters.
- Identify the type of grinding operation (peripheral or facing).

Subject Outcome 3: Perform surface-grinding operations.

Learning Outcomes:

The student should be able to:
- Apply automatic lubrication system.
- Start and set depth.
- Engage automatic feed.
- Adjust lateral table movement.
- Adjust coolant and flood work piece.

Subject Outcome 4: Apply quality checks on machined component.

Learning Outcomes:

The student should be able to:
- Select correct tools and equipment for quality checking.
- Identify values to be checked.
- Check grinding operation and make necessary adjustments.
- Check surface finish.

Subject Outcome 5: Record information on work done.

Learning Outcomes:

The student should be able to:
- Select a name for the file.
- Record the information on work done in the file.
- Save the file for reference purposes.

Subject Outcome 6: Recognise and report problems, changes and/or malfunctions while operating.

Learning Outcome:

The student should be able to:
- Recognise and report malfunctions.

Subject Outcome 7: Work safely with care for self, fellow workers, machines, equipment, materials and environment.

Learning Outcomes:

The student should be able to:

- Apply worksite health and safety practices.
- Clean equipment, materials and machines after use.
- Wear safety clothes.
- Clean work area after completion of the task.
- Apply good housekeeping.

7.5 Topic 5: Operate and Monitor a Lathe to Produce Simple Components

Subject Outcome 1: Prepare for work activity.

Learning Outcomes:

The student should be able to:

- Select tools and equipment required for lathe operation.
- Check whether tools and equipment are in good working condition.
- Check whether the machine is in good working condition.
- Practice workshop safety.

Subject Outcome 2: Set lathe.

Learning Outcomes:

The student should be able to:

- Fit selected cutter in tool post and adjust cutter height.
- Set the graduated sleeve of the cross-slide to zero.
- Set the compound slide to zero.
- Position carriage for cut.
- Mount the work piece in a three or four-jaw chuck.
- Clamp securely and check the set-up.
- Determine work piece diameter and calculate RPM considering material type as well.
- Determine feed rate and cutting depth.

Subject Outcome 3: Perform turning operations.

Learning Outcomes:

The student should be able to:

- Adjust calculated RPM.
- Adjust feed rate.
- Set cutter against work piece and adjust cutting depth.
- Engage automatic or manual feed.

Subject Outcome 4: Apply quality checks on machined component.

Learning Outcomes:

The student should be able to:

- Select correct tools and equipment for quality checking.
- Identify values for checking.
- Check cutting surface finish.

Subject Outcome 5: Record information on work done.

Learning Outcomes:

The student should be able to:

- Select a name for the file.
- Record the information on work done in the file.
- Save the file for reference purposes.

Subject Outcome 6: Recognise and report problems, changes and/or malfunctions while operating.

Learning Outcome:

The student should be able to:

- Recognise and report problems.
- Recognise and report changes.
- Recognise and report malfunctions.

Subject Outcome 7: Work safely with care for self, fellow workers, machines, equipment, materials and environment.

Learning Outcomes:

The student should be able to:

- Apply worksite health and safety practices.
- Clean equipment, materials and machines after use.
- Wear safety clothes.
- Clean work area after completion of the task.
- Apply good housekeeping.

7.6 Topic 6: Perform Basic Welding or Joining of Metals

Subject Outcome 1: Prepare for work activity.

Learning Outcomes:

The student should be able to:

- Select tools and equipment required for welding or joining of metals.
- Check whether tools and equipment are in good working condition.
- Check whether the machine is in good working condition.
- Practice workshop safety.

Subject Outcome 2: Weld or join metals.

Learning Outcomes:

The student should be able to:

- Select the electrode size (welding rod).
- Set the desired amperage.
- Adjust the shielding gas flow.
- Adjust the rate of wire feed.
- Control the torch movement and wire extension.
- Wear welder's clothing.
- Ventilate welding area.
- Clean metals before welding or joining.

Subject Outcome 3: Apply quality checks on completed weld or joint.

Learning Outcomes:

The student should be able to:

- Examine weld for penetration.
- Determine whether the weld conforms to the drawing specifications.
- Identify values to be checked.
- Check for warping and twisting of work piece.
- Check dimensions against drawing.

Subject Outcome 4: Perform finishing activities.

Learning Outcomes:

The student should be able to:

- Clean surplus weld and spatter.
- Clean work piece surface and apply required surface coating.

Subject Outcome 5: Report incompliant or unsafe conditions while working.

Learning Outcomes:

The student should be able to:

- Inspect the working conditions.

- Identify any problems.
- List the unsafe conditions.
- Prepare a report on incompliant or unsafe conditions.

Subject Outcome 6: Work safely with due care for self, fellow workers, equipment and materials.

Learning Outcomes:

The student should be able to:
- Apply worksite health and safety practices.
- Clean equipment, materials and machines after use.
- Wear safety clothes.
- Clean work area after completion of the task.
- Apply good housekeeping.

8 RESOURCES NEEDS FOR THE TEACHING OF FITTING AND TURNING – LEVEL 2

8.1 Physical resources

Building infrastructure, fixtures, networks, plant and machinery, for example:
- Storeroom
- Tool room
- Lecture room(s)
- Training area or work area
- Ablution facilities

8.2 Human resources

The lecturer for Engineering Fundamentals Level 2 must be:
- a subject matter expert,
- certificated as an assessor with the ETDP SETA,
- registered with an ETQA or SETA,
- a life-long student,
- in possession of an NQF Level 5 teaching qualification,
- conversant with outcomes-based methodologies, and
- skilled in facilitating learning programme development.

Lecturers must attend seminars and upgrading workshops to keep up-to-date with the latest developments in technology.

8.3 Other resources

Consumables, individual tool and equipment requirements and learning materials and resources, for example:

- Literature and learning material which address tasks
- Learning materials on projection equipment
- Educational tours to relevant learning venues
- Educational and motivational talks from industry
- Visual and audio-visual material
- Workshop manuals and documentation for theoretical knowledge
- Models and demonstrations

Funds from the learning provider or funding bodies for the procurement of consumables, tools and equipment must be readily available to ensure the effective operation of a Simulated Environment where students are individually equipped with the necessary tools.