education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

SUBJECT GUIDELINES

ENGINEERING PRACTICE AND MAINTENANCE

NQF Level 3

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ENGINEERING PRACTICE AND MAINTENANCE – LEVEL 3

CONTENTS

INTRODUCTION

A. What is Engineering Practice and Maintenance?

Engineering Practice and Maintenance is the research of new exciting systems to manage and control operations, such as fault finding and solutions for mechanical and electrical equipment in a production plant. Information, communication and technology is used to develop solutions for given design problems.

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

Engineering Practice and Maintenance gives students the opportunity to engage with the principles of fault finding diagnostics in the engineering industry, where systematic collection and analysis of evidence leads to identification of symptoms of a fault as a systematic approach. After fault location appropriate procedures are followed to ensure that faults are rectified

C. The link between the Engineering Practice and Maintenance Learning Outcomes and the Critical and Developmental Outcomes.

Engineering Practice and Maintenance will develop students' problem solving skills by requiring them to recognise hazards and defects and respond appropriately.

The subject will instil and enhance independence and self-management skills.

There is a strong emphasis on collection, analysis, organisation and critical evaluation of information as students learn to:

- Plan a sequence of operations based on job instructions and set up equipment appropriately
- Plan and use drawing knowledge
- Interpret information off job instructions and make decisions based on that information.

Engineering Fundamentals will also create a sense of respect and responsibility towards the environment as well as the health and safety of fellow human beings.

D. Factors that contribute to achieving Engineering Practice and Maintenance Learning Outcomes are as follows;

A student must have a desire to work in this field, to improve on the already existing systems, and manage and research improvements to maintenance applications

The topics allow stimulation of thinking and a desire to achieve success.

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 candidate meets all the assessment requirements.

Course preparations should consider students with special education needs.

2 SUBJECT LEVEL FOCUS

- Knowledge of engineering systems and procedures and systems control
- Mechanical and electrical fault finding in engineering
- Knowledge of lubricants and lubrication systems
- Maintenance of plant and equipment in engineering

3 ASSESSMENT REQUIREMENTS

3.1 Internal assessment (50 percent)

3.1.1 Theoretical Component

The theoretical component will form 40 percent of internal assessment.

Internal assessment of the theoretical component of Engineering Practice and Maintenance Level 3 will take the form of observation, class question, group work, individual discussion with students, topic and semester tests, internal examinations. Observation can be done on completion of work piece.

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

3.1.2 Practical Component

The practical component includes applications and exercises. All practical work must be indicated in a Portfolio of evidence (PoE).

The practical component will form 60 percent part of internal assessment.

Internal assessment of the practical component of Engineering Practice and Maintenance Level 3 will take the form of assignments practical exercises, practical examination in a workshop environment. Students may complete practical exercises on a daily basis. Assignments can be done at the end of a topic. The practical examination can form part of internal practical assessment.

- **Some examples of practical assessments include, but are not limited to:**
  - Presentations (lectures, demonstrations, group discussions and activities, practical work, observations, role play, independent activity, synthesis and evaluation.
  - Exhibition by students
  - Visits undertaken by students based on a structured assignment task
  - Task performance simulated in a structured environment

- **Definition of the term "Structured Environment"**

For the purposes of assessment "structured environment" refers to an actual or simulated workplace, or a computer or a workshop environment

- **Evidence in practical assessments**

All evidence pertaining to evaluation of practical work must be reflected in the student PoE. The tools and equipment required for the purpose of conducting such assessments must be clear from evidence contained in the 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 and the practical component of the internal continuous assessment.

3.1.4 Moderation of internal assessment mark

Internal assessment is subject to both internal and external moderation procedures as contained 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 externally and marked and moderated externally.

Details in respect of external assessment are contained in the *Assessment Guidelines: Engineering Practice and Maintenance* (Level 3).

4 WEIGHTED VALUES OF THE TOPICS

TOPICS	WEIGHTED VALUES
1. Technological solutions in engineering	20%
2. Systematic fault finding techniques	20%
3. Diagnosis of mechanical and electrical faults in engineering	20%
4. Lubricants and lubrication systems	20%
5. Maintenance of plant and equipment in engineering	20%
TOTAL	**100**

5 CALCULATION OF FINAL MARK

Continuous Assessment: Student's mark/100 x 50/1 = a mark out of 50 (a)

Theoretical Examination Mark: Student's mark/100 x 50/1 = 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, purposes of moderation and verification.

6 PASS REQUIREMENTS

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

7 SUBJECT AND LEARNING OUTCOMES

On completion of Engineering Practice and Maintenance Level 3 the student should have covered the following topics:

Topic 1: Technological solutions in engineering
Topic 2: Systematic fault finding techniques
Topic 3: Diagnosis of mechanical and electrical faults in engineering
Topic 4: Lubricants and lubrication systems
Topic 5 Maintenance of plant and equipment in engineering

7.1 Topic 1: Technological solutions in engineering

7.1.1 Subject Outcome: Explain different forms of information, communication and technologies used in engineering.

Learning Outcome:

- Identify forms of information, communication and technologies in terms of their characteristics.
- Decide on information, communication and technology that can be used to produce solutions.

  Range: Technological solutions also include modifications and upgrades.

7.1.2 Subject Outcome 2: Use information, communication and technologies to develop a solution for a given design problem.

Learning Outcome:

- Describe existing solutions to similar problems.
- Decide on a solution in order to solve the design problem according to its design process.
- Develop a solution for the design problem.

7.1.3 Subject Outcome 3: Test and evaluate the solution and make the necessary modifications.

Learning Outcome:

- Compare methods of testing and evaluation.
- Test and evaluate information, communication and technologies against the given specifications of the design problem.
- Identify modifications where necessary.
- Make any necessary modifications and justify the solution in terms of the given design problem.

7.2 Topic 2: Systematic fault finding techniques

7.2.1 Subject Outcome 1: Research systematic fault finding techniques that can be used to locate a fault.

Learning Outcome:

- List fault finding techniques from manufacturer's manuals and other resources.
- Discuss different fault finding techniques.
- Discuss positive and negative aspects of different techniques.

7.2.2. Subject Outcome 2: Identify symptoms of a fault**.**

Learning Outcome:

- List methods of identifying symptoms of faults.
- Identify symptoms by using, questioning the customer and direct observation, as different methods of identification.
- Use data and information collected and make a judgement call on the fault without identifying the cause of the fault until after investigation.
- Separate relevant symptoms from irrelevant symptoms and identify their side effects.
- Identify the cause of the fault obtained from relevant symptoms.

7.2.3 Subject Outcome 3: Locate faults in electrical and/or mechanical appliances and determine their cause.

Learning Outcome:

- Discuss techniques used to locate electrical and/or mechanical faults
- Locate a fault and deduce a cause that is supported by direct observation and measurements.
- Locate a fault and deduce a cause without trial and error replacement of parts.
- Locate a fault and deduce cause by making use of manufacturer's servicing data and drawings.

7.3 Topic 3: Diagnosis of mechanical and electrical faults in engineering

7.3.1 Subject Outcome 1: Evaluate the principles of fault finding diagnoses in the engineering industry.

Learning Outcome:

- List the principles of fault finding diagnostics.
- Discuss these principles in terms of the systematic investigation of symptoms, fault and cause effects.
- Analyse principles as a process or a process within a system.
- Evaluate associated inputs and resulting outcomes in correcting the fault.

7.3.2 Subject Outcome 2: Evaluate the systematic approach to fault location.

Learning Outcome:

- Analyse the systematic approach to fault location in terms of the difference between a symptom and a cause.
- Analyse the systematic approach to fault location in terms of common aids to fault location and examples of their application in fault location.
- Contrast systematic search methods with the random search method and examples of their application in fault location.

7.3.3 Subject Outcome 3: Investigate and use appropriate procedures to rectify faults.

Learning Outcome:

- Identify causes of a fault in a specific situation.
- Identify procedures that can be used to fix a fault.
- Decide on the appropriate procedure to rectify the fault.
- Identify channels to be used to notify personnel about the fault and the procedure used to rectify the problem.
- Communicate the appropriate procedure to be used to personnel.
- Record all details of the fault and the procedure used to rectify the fault.

7.3.4 Subject Outcome 4: Explain the systematic collection and analysis of evidence to identify symptoms of a fault.

Learning Outcome:

- Explain the systematic collection of evidence in terms of the five-step approach to fault finding.
- Explain the systematic collection of evidence in terms of defining a symptom as a sign to help in locating a fault.

7.4 Topic 4: Lubricants and lubrication systems.

7.4.1 Subject Outcome 1: Explain and interpret lubrication principles and characteristics.

Learning Outcome:

- Identify different types of lubricants available.
- Discuss lubrication principles
- Describe lubricants in terms of performance characteristics.
- Describe lubricants in terms of their role in machine components.
- Access and interpret information about lubricants to meet machine operation requirements.

7.4.2 Subject Outcome 2: Inspect lubrication systems

Learning Outcome:

- List different lubrication systems
- Identify the type of lubrication system to be inspected.
- Determine lubrication requirements for the system from information sources.
- Check system for conformance in accordance with manufacturer's specifications and worksite procedures.
- Diagnose system faults and take correct actions in accordance with worksite procedures.

7.4.3 Subject Outcome 3: Explain different lubrication system faults.

Learning Outcome:

- Describe typical faults relative to the system selected.
- Identify fault-testing methods relative to the system selected.
- Describe fault-recording techniques in accordance with worksite procedures.

7.5 Topic 5: Maintenance of plant and equipment in engineering.

7.5.1 Subject Outcome 1: Describe plant and equipment currently used in engineering and explain the principles for correct usage.

Learning Outcome:

- List different plant and engineering equipment.
- Determine the purpose of plant and engineering equipment according to manufacturer's specifications and company policy.
- Identify principles of operation of plant and engineering equipment according to manufacturer's specifications and company policy.

7.5.2 Subject Outcome 2: Explain and demonstrate safety procedures when using plant and engineering equipment

Learning Outcome:

- Describe safety procedures when using plant and engineering equipment according to manufacturer's specifications, company policy, and legislation.
- Use correct safety procedures when operating potentially hazardous/dangerous equipment.

7.5.3 Subject Outcome 3: Select and use plant and engineering equipment relevant to the workplace.

Learning Outcome:

- Select suitable equipment for a relevant task according to the purpose of the designed equipment.
- Use the selected piece of equipment according to manufacturer's specifications and company policy.
- Adhere to safe working practises throughout the usage of the equipment.
- Shut down and store equipment in accordance to the workplace and manufacturer's specifications.

7.5.4 Subject Outcome 4: Maintain plant and engineering equipment

Learning Outcome:

- Familiarise oneself with the maintenance policy and procedures for plant and engineering equipment.
- Clean plant and equipment after usage according to specifications, company policy and procedures.
- Store plant and equipment in a proper place to prevent any damages.
- Inspect plant and equipment to ensure it is in a safe working condition according to manufacturer's specifications and company policy.
- Adhere to safe working practises throughout the maintenance procedures.

8 RESOURCE NEEDS FOR THE TEACHING OF ENGINEERING PRACTICE AND MAINTENANCE - LEVEL 3

8.1 Human resources

The educator for Engineering Practice and Maintenance Level 3 must be:

- A subject matter expert
- Certificated as an assessor with ETDP SETA
- Registered with an ETQA or SETA
- A life-long student
- Computer literate
- In possession of an NQF level 5 teaching qualification
- Conversant with OBE methodologies
- Instructor qualified in the field of study
- Have skills in facilitating learning programmes development
- A trade test will be an added advantage

It is of importance that educators working in this environment attend seminars and upgrading workshops in order to be updated and re-skilled with the latest developments in technology.

8.2 Physical resources

- Store room-consumable
- Tool room.
- Lecture room(s)
- Training area-work area
- Ablution facilities
- Funds from learning provider or funding bodies will be necessary for the procurement of consumables. Tools and equipment must be readily made available for the effective operation of a workplace involved in a training programme and students individually equipped with necessary tools.
- Store room in the case of heavy consumables is to to be equipped with mechanical lifting devices suitable for the storage purpose

8.3 Teaching and learning resources

- Learning materials must conform to approved training and industrial standard requirements and articulate to Higher Education
- Literature that fully addresses the tasks for the learning material.
- Learning materials for use with projection equipment.
- Promotion of research
- Educational tours to relevant learning venues
- Educational and motivational talks from industry
- Visual and Audio-visual material
- Workshop manuals and documentation for the theoretical knowledge
- Models and demonstrations.