



**County Dublin VEC**

**Programme Module for  
Engineering Workshop Theory**

**leading to**

**Level 5 FETAC**

**Engineering Workshop Theory 5N2136**

### Introduction

This programme module may be delivered as a standalone module leading to certification in a FETAC minor award. It may also be delivered as part of an overall validated programme leading to a Level 5 FETAC Certificate.

The teacher/tutor should familiarise themselves with the information contained in County Dublin VEC's programme descriptor for the relevant validated programme prior to delivering this programme module.

The programme module is structured as follows:

1. Title of Programme Module
2. FETAC Component Title and Code
3. Duration in hours
4. Credit Value of FETAC Component
5. Status
6. Special Requirements
7. Aim of the Programme Module
8. Objectives of the Programme Module
9. Learning Outcomes
10. Indicative Content
11. Assessment <ul style="list-style-type: none"> <li>a. Assessment Technique(s)</li> <li>b. Mapping of Learning Outcomes to Assessment Technique(s)</li> <li>c. Guidelines for Assessment Activities</li> </ul>
12. Grading
13. Learner Marking Sheet(s), including Assessment Criteria

### Integrated Delivery and Assessment

The teacher/tutor is encouraged to integrate the delivery of content where an overlap between content of this programme module and one or more other programme modules is identified. This programme module will facilitate the learner to develop the academic and vocational language, literacy and numeracy skills relevant to the themes and content of the module.

Likewise the teacher/tutor is encouraged to integrate assessment where there is an opportunity to facilitate a learner to produce one piece of assessment evidence which demonstrates the learning outcomes from more than one programme module. The integration of the delivery and assessment of level 5 Communications and level 5 Mathematics modules with that of other level 5 modules is specifically encouraged, as appropriate.

**Indicative Content**

The indicative content in Section 10 does not cover all teaching possibilities. The teacher/tutor is encouraged to be creative in devising and implementing other approaches, as appropriate. The use of examples is there to provide suggestions. The teacher/tutor is free to use other examples, as appropriate. The indicative content ensures all learning outcomes are addressed but it may not follow the same sequence as that in which the learning outcomes are listed in Section 9. It is the teacher's/tutor's responsibility to ensure that all learning outcomes are included in the delivery of this programme module.

<p><b>1. Title of Programme Module</b> Engineering Workshop Theory</p>
<p><b>2. Component Name and Code</b> Engineering Workshop Theory 5N2136</p>
<p><b>3. Duration in Hours</b> 150 Hours (typical learner effort, to include both directed and self directed learning)</p>
<p><b>4. Credit Value</b> 15 Credits</p>
<p><b>5. Status</b> This programme module may be compulsory or optional within the context of the validated programme. Please refer to the relevant programme descriptor, Section 9 Programme Structure</p>
<p><b>6. Special Requirements</b> None</p>
<p><b>7. Aim of the Programme Module</b> This programme module aims to facilitate the learner to become familiar with the practical procedures for the manufacture of engineering artefacts and the inspection techniques associated with those procedures, while considering health and safety requirements</p>
<p><b>8. Objectives of the Programme Module</b></p> <ul style="list-style-type: none"> <li>• To facilitate the learner to explore the different manufacturing processes, both manual and computer controlled, within an engineering workshop</li> <li>• To enable the learner to use a range of mathematical calculation techniques</li> <li>• To facilitate the learner to develop an understanding of current legislation and legal responsibilities in relation to best workshop practices</li> <li>• To enable the learner to demonstrate a knowledge of the different engineering materials, tools and parts</li> <li>• To create an awareness of the importance the role of measurement and inspection plays in the manufacturing process</li> <li>• To assist the learner to develop the academic and vocational terminology and numeracy skills related to engineering theory through the medium of the indicative content</li> <li>• To enable the learner to take responsibility for his/her own learning.</li> </ul>

**9. Learning Outcomes of Level 5 Engineering Workshop Theory 5N2136**

Learners will be able to:

1. Analyse key principles relating to the materials, machinery and processes utilised in an engineering workshop environment
2. Interpret key terminology, symbols and units of measure in relation to components, tools, machinery, procedures and techniques, utilised in an engineering workshop environment
3. Explain the function and characteristics of a range of engineering machinery, to include various types of lathes, milling, grinding and drilling machines
4. Explain the function and characteristics of a range of components found in engineering machinery, to include tooling, motors, gearing, switches, cutters and guards.
5. Describe the key properties and applications of a range of materials utilised in an engineering workshop environment, to include alloys, polymers, ceramics, liquids, composite and natural materials
6. Describe the key characteristics and appropriate applications of a range of jointing techniques to include arc welding, gas welding, brazing and soldering.
7. Illustrate and describe the characteristics and application of a range of fixings to include bolts, screws and adhesives
8. Create a program suitable for use on computer numerical control (CNC) equipment
9. Employ a range of mathematical calculation techniques to solve engineering related problems
10. Analyse the effect of new technologies on the choice of materials and processes utilised in the engineering sector
11. Describe and illustrate the key characteristics of a range of test and calibration equipment employed in an engineering workshop environment
12. Suggest a maintenance schedule for tools and equipment utilised in an engineering workshop
13. Suggest a range of initiatives aimed at improving health and safety in relation to engineering workshop practices and suggest strategies aimed at reducing associated risks
14. Analyse current legislation and identify key legal responsibilities in relation to use of machinery in an engineering workshop environment

**10. Indicative Content**

This section provides suggestions for programme content but is not intended to be prescriptive. The programme module can be delivered through classroom based learning activities, group discussions, one-to-one tutorials, field trips, case studies, role play and other suitable activities, as appropriate.

**Section 1 : Safety and Health**

Learning Outcomes: 13, 14

Facilitate the learner to analyse current legislation in relation to health and safety, for example:

- Safety and health at work
- Manual handling
- Using Personal protective equipment (PPE)
- Working with electricity, chemicals, gas, flammable or explosive materials
- Working in confined spaces

Introduce to the learner the concepts of:

- Hazard
- Risk associated with a hazard
- Risk assessment
- Employer rights and responsibilities
- Employee rights and responsibilities

Having analysed current legislation, facilitate the learner to identify the key legal responsibilities related to using machinery in an engineering workshop environment, to include:

- Safety specifications and standards of machinery/tools
- The periodic inspection durations for specific machines/tools
- Training and certification

Explore with the learner initiatives to improve health and safety in the engineering workshop, for example:

- Demonstrate correct procedures for using equipment
- Encourage safe working practices
- Provide appropriate health and safety courses
- Undertake field trips
- Undertake work placement in an appropriate setting

Facilitate the learner to suggest strategies to reduce the risks associated with engineering workshop practices, for example:

- Ensure machinery is serviced and fit for purpose
- Ensure awareness of emergency measures and procedures
- Use of appropriate Personal Protective Equipment

**Section 2: Engineering Processes**

Learning Outcomes: 1, 3, 6, 7, 8, 10

Enable the learner to demonstrate a knowledge and understanding of the different materials that are used in the engineering workshop to include:

- Steels and their alloys
- Iron

- Copper and its alloys
- Brass and its alloys
- Aluminium and its alloys
- Common plastics incorporating where possible (polythene, pvc, polystyrene, polypropylene, polyurethane and nylon)

Explore with the learner the many different functions and characteristics of engineering workshop machines including the construction of their main components, to include the following

- The Centre Lathe
- The Pillar Drill
- Milling machine
- Grinder

Identify with the learner the main processes of the machines common to an engineering workshop

- The Centre Lathe processes include the following
  - i) Facing off ii) Parallel turning iii) Drilling iv) Knurling v) Taper Turning vi) Reaming
- The Pillar drill processes to include the following
  - i) Drilling ii) Reaming
- The milling machine processes to include the following
  - i) Peripheral milling ii) Face milling iii) Using various different milling tools including
    - End milling bits
    - Slot milling bits
    - Dovetail cutters
    - Ball-nosed cutters
    - Angle cutter
- Grinding processes to including
  - i) Surface Grinding ii) Cylindrical Grinding iii) Centre-less Grinding
- Assist the learner to identify the characteristics of the various types of welding, brazing and soldering including:
  - Gas Welding
  - Tungsten Arc Gas Shielded
  - Manual Arc Gas Shielded
  - Oxy Acetylene Welding
  - Arc Welding
  - Manual metal arc
  - Submerged Arc Welding
  - Resistance welding
  - Spot welding
- Brazing and soldering
  - Braze welding
  - Silver soldering
  - Soft soldering
  - Hard soldering

Facilitate the learner to ascertain the appropriate applications and operations of a range of joining methods to include:

- arc welding
- gas welding
- brazing and soldering

Enable the learner to create a program suitable for use on computer numerical control (CNC) equipment

Enable the learner to analyse the effect of new technologies on the choice of materials and processes utilised in the engineering sector

Enable the learner to illustrate the different mechanical joining processes to include:

- Riveting
- Screw types i) Hex head ii) Cheese head iii) Countersink iv) Round head v) Pan head vi) Raised head vii) Grub Screw

### **Section 3: Engineering Components**

Learning Outcome: 4

Enable the learner to explain the function of a range of components found in engineering machinery including

- lathe tool geometry and angles
- drill bit geometry
- milling cutters geometry and function

Facilitate the learner to identify and explain the different parts and functions of the following engineering components

- motors
- various gear types
- switches
- machine guards

### **Section 4: Properties and Applications of Engineering Materials**

Learning Outcome: 5

Facilitate the learner to describe the key properties of materials utilised in an engineering workshop environment to include:

- Alloys (both ferrous and non-ferrous) to include
  - i) Plain carbon and alloy steels
  - ii) Grey and white cast iron
  - iii) Copper alloys
  - iv) Aluminium alloys
- Polymers both thermoplastic and thermosetting to include
  - i) polythene
  - ii) pvc
  - iii) polystyrene
  - iv) polypropylene
  - v) polyurethane

- vi) nylon

### Section 5: Measurement and Inspection

Learning Outcome 2, 9, 11, 12

Enable the learner to interpret key terminology, symbols and units of measure that are used in the engineering workshop to include

- Absolute and incremental dimensioning
- ISO system of limits and fits

Describe the function and construction of different measurement equipment including:

- i) The micrometer
- ii) Vernier callipers
- iii) Vernier height gauge

Describe the principle operation of go and no-go gauges and measurement of angles using a sine bar

Enable the learner to employ a range of mathematical calculations to solve engineering related problems to include:

- cutting speeds
- feed rates
- depth of cut
- Offsetting
- Cutting angles

Facilitate the learner to design a maintenance schedule for tools and equipment utilised in an engineering workshop

Enable the learner to describe different test equipment and how they are used to test different materials and the properties they reveal to include the following tests:

- Destructive testing
  - i) Brinell
  - ii) Vickers
  - iii) Rockwell
  - iv) Izod
  - v) Charpy
  - vi) Tensile testing
- Non-destructive testing
  - i) X-ray
  - ii) Ultrasound
  - iii) Dye penetrant testing

Enable the learner to illustrate using graphs and diagrams the test results from the testing equipment

**11. Assessment****11a. Assessment Techniques**

Assignment	50%
Examination-Theory	50%

**11b. Mapping of Learning Outcomes to Assessment Techniques**

In order to ensure that the learner is facilitated to demonstrate the achievement of all learning outcomes from the component specification; each learning outcome is mapped to an assessment technique(s). This mapping should not restrict an assessor from taking an integrated approach to assessment.

<b>Learning Outcome</b>	<b>Assessment Technique</b>
1. Analyse key principles relating to the materials, machinery and processes utilised in an engineering workshop environment	Assignment
2. Interpret key terminology, symbols and units of measure in relation to components, tools, machinery, procedures and techniques, utilised in an engineering workshop environment	Examination - Theory
3. Explain the function and characteristics of a range of engineering machinery, to include various types of lathes, milling, grinding and drilling machines	Assignment
4. Explain the function and characteristics of a range of components found in engineering machinery, to include tooling, motors, gearing, switches, cutters and guards.	Examination – Theory
5. Describe the key properties and applications of a range of materials utilised in an engineering workshop environment, to include alloys, polymers, ceramics, liquids, composite and natural materials	Examination – Theory
6. Describe the key characteristics and appropriate applications of a range of jointing techniques to include arc welding, gas welding, brazing and soldering.	Assignment
7. Illustrate and describe the characteristics and application of a range of fixings to include bolts, screws and adhesives	Examination – Theory
8. Create a program suitable for use on computer numerical control (CNC) equipment	Assignment
9. Employ a range of mathematical calculation techniques to solve engineering related problems	Examination – Theory
10. Analyse the effect of new technologies on the choice of materials and processes utilised in the engineering sector	Assignment
11. Describe and illustrate the key characteristics of a range of test and calibration equipment employed in an engineering workshop environment	Examination – Theory
12. Suggest a maintenance schedule for tools and equipment utilised in an engineering workshop	Examination – Theory
13. Suggest a range of initiatives aimed at improving health and safety in relation to engineering workshop practices and suggest strategies aimed at reducing associated risks	Assignment
14. Analyse current legislation and identify key legal responsibilities in relation to use of machinery in an engineering workshop environment	Assignment

**11c. Guidelines for Assessment Activities**

The assessor is required to devise an assessment brief and marking scheme for the assignment and an examination paper, marking scheme and outline solutions for the examination – theory. In devising the assessment brief and examination paper, care should be taken to ensure that the learner is given the opportunity to show evidence of achievement of ALL the learning outcomes

Assessment briefs may be designed to allow the learner to make use of a wide range of media in presenting assessment evidence, as appropriate. Quality assured procedures must be in place to ensure the reliability of learner evidence.

Assignment	50%
Each assignment will take a minimum of three weeks	
<p>The learner will undertake two assignments based on the learning outcomes listed above in section 11b</p> <p>The assessor will devise two briefs that require candidates to produce evidence that demonstrates an understanding and application of a wide range of specific learning outcomes</p> <p><b>Assignment 1:</b> The assessor will devise an assignment on machining and manufacturing in an engineering workshop to incorporate the following learning outcomes: 1,3,6,8</p> <p>Assignment weighting 30%</p> <p><b>Assignment 2:</b> The assessor will devise an assignment on safety in an engineering workshop environment and technology and its effect on society based on learning outcomes: 10,13,14</p> <p>Assignment weighting 20% .</p> <p>For each assignment, learners will carry out an investigation of a topic that demonstrates an understanding and application of concepts in engineering workshop theory.</p> <p>Learners will use appropriate research methods, analyse the findings and present conclusions and recommendations.</p> <p>Evidence for this assessment technique may take the form of written, oral, graphic, audio, visual or digital evidence, or any combination of these. Any audio, video or digital evidence must be provided in a suitable format.</p> <p>All instructions for the learner must be clearly outlined in an assessment brief</p>	

<b>Examination</b>	<b>50%</b>
<b>2 Hour examination</b>	
The learner will complete a 2 hour theory examination made up of part A and part B, as follows:  Part A: 12 short answer questions to answer any 10 ( 4 marks each)  Part B: 4 structured questions answer any 3 ( 20 marks each)  All instructions for the learner must be clearly outlined in an examination paper	

**12. Grading**

Distinction: 80% - 100%

Merit: 65% - 79%

Pass: 50% - 64%

Unsuccessful: 0% - 49%

At levels 4, 5 and 6 major and minor awards will be graded. The grade achieved for the major award will be determined by the grades achieved in the minor awards.

<b>Engineering Workshop Theory 5N2136</b>	<b>Learner Marking Sheet Assignment 1 30%</b>
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Learner's Name: \_\_\_\_\_

Learner's PPSN: \_\_\_\_\_

<b>Assessment Criteria</b>	<b>Maximum Mark</b>	<b>Learner Mark</b>
Examine key principles relating to a selection of engineering materials and their properties and assess their machinability in relation to a number of different engineering processes	10	
Investigate two pieces of engineering equipment and outline: <ol style="list-style-type: none"> <li>1. Function</li> <li>2. Parts</li> <li>3. Operations</li> <li>4. Safety</li> </ol>	20	
Examine any two welding/brazing/ soldering processes, to include <ol style="list-style-type: none"> <li>1. Joining techniques</li> <li>2. Key functions</li> <li>3. Operations</li> <li>4. Safety</li> </ol>	20	
Devise a CNC program for a sample part to be manufactured	10	
<b>Total Mark</b>	60	
<b>Total Percentage</b>	60 marks/2 30%	

Assessor's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

External Authenticator's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

<b>Engineering Workshop Theory 5N2136</b>	<b>Learner Marking Sheet Assignment 2 20%</b>
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Learner's Name: \_\_\_\_\_

Learner's PPSN: \_\_\_\_\_

<b>Assessment Criteria</b>	<b>Maximum Mark</b>	<b>Learner Mark</b>
Investigate the effect new technologies have made on the choice of materials and processes that we now use in the engineering sector compared to twenty years ago	10	
Conduct a health and safety review of any engineering workshop and outline <ol style="list-style-type: none"> <li>1. Safety rules and regulations</li> <li>2. Risks</li> <li>3. Hazards</li> <li>4. Hazard prevention</li> </ol>	20	
Analyse current legislation and identify key legal responsibilities in relation to use of machinery in an engineering workshop environment	10	
<b>Total Mark</b>	40	
<b>Total Percentage</b>	40 marks/2 20%	

Assessor's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

External Authenticator's Signature: \_\_\_\_\_

Date: \_\_\_\_\_

