The Further Education and Training Awards Council (FETAC) was set up as a statutory body on 11 June 2001 by the Minister for Education and Science. Under the Qualifications (Education & Training) Act, 1999, FETAC now has responsibility for making awards previously made by NCVA.

Module Descriptor

Engineering Workshop
Theory

Level 5  C20167

www.fetac.ie
## Level 5 Module Descriptor

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<th>Description</th>
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<td>Describes how the module functions as part of the national vocational certificate framework.</td>
</tr>
<tr>
<td>Module Title</td>
<td>Indicates the module content. This title appears on the learner’s certificate. It can be used to download the module from the website <a href="http://www.fetac.ie">www.fetac.ie</a>.</td>
</tr>
<tr>
<td>Module Code</td>
<td>An individual code is assigned to each module; a letter at the beginning denotes a vocational or general studies area under which the module is grouped and the first digit denotes its level within the national vocational certificate framework.</td>
</tr>
<tr>
<td>Level</td>
<td>Indicates where the module is placed in the national vocational certificate framework, from Level 3 to Level 6.</td>
</tr>
<tr>
<td>Credit Value</td>
<td>Denotes the amount of credit that a learner accumulates on achievement of the module.</td>
</tr>
<tr>
<td>Purpose</td>
<td>Describes in summary what the learner will achieve on successfully completing the module and in what learning and vocational contexts the module has been developed. Where relevant, it lists what certification will be awarded by other certification agencies.</td>
</tr>
<tr>
<td>Preferred Entry Level</td>
<td>Recommends the level of previous achievement or experience of the learner.</td>
</tr>
<tr>
<td>Special Requirements</td>
<td>Usually ‘none’ but in some cases detail is provided here of specific learner or course provider requirements. There may also be reference to the minimum safety or skill requirements that learners must achieve prior to assessment.</td>
</tr>
<tr>
<td>General Aims</td>
<td>Describe in 3-5 statements the broad skills and knowledge learners will have achieved on successful completion of the module.</td>
</tr>
<tr>
<td>Units</td>
<td>Structure the learning outcomes; there may be no units.</td>
</tr>
<tr>
<td>Specific Learning Outcomes</td>
<td>Describe in specific terms the knowledge and skills that learners will have achieved on successful completion of the module.</td>
</tr>
<tr>
<td>Portfolio of Assessment</td>
<td>Provides details on how the learning outcomes are to be assessed.</td>
</tr>
<tr>
<td>Grading</td>
<td>Provides details of the grading system used.</td>
</tr>
<tr>
<td>Individual Candidate Marking Sheets</td>
<td>List the assessment criteria for each assessment technique and the marking system.</td>
</tr>
<tr>
<td>Module Results Summary Sheet</td>
<td>Records the marks for each candidate in each assessment technique and in total. It is an important record for centres of their candidate’s achievements.</td>
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<tr>
<td>Appendices</td>
<td>Can include approval forms for national governing bodies.</td>
</tr>
<tr>
<td>Glossary of Assessment Techniques</td>
<td>Explains the types of assessment techniques used to assess standards.</td>
</tr>
<tr>
<td>Assessment Principles</td>
<td>Describes the assessment principles that underpin FETAC approach to assessment.</td>
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Introduction

A module is a statement of the standards to be achieved to gain a FETAC award. Candidates are assessed to establish whether they have achieved the required standards. Credit is awarded for each module successfully completed.

The standards in a module are expressed principally in terms of specific learning outcomes, i.e. what the learner will be able to do on successful completion of the module. The other elements of the module - the purpose, general aims, assessment details and assessment criteria - combine with the learning outcomes to state the standards in a holistic way.

While FETAC is responsible for setting the standards for certification in partnership with course providers and industry, it is the course providers who are responsible for the design of the learning programmes. The duration, content and delivery of learning programmes should be appropriate to the learners’ needs and interests, and should enable the learners to reach the standard as described in the modules. Modules may be delivered alone or integrated with other modules.

The development of learners’ **core skills** is a key objective of vocational education and training. The opportunity to develop these skills may arise through a single module or a range of modules. The core skills include:

- taking initiative
- taking responsibility for one’s own learning and progress
- problem solving
- applying theoretical knowledge in practical contexts
- being numerate and literate
- having information and communication technology skills
- sourcing and organising information effectively
- listening effectively
- communicating orally and in writing
- working effectively in group situations
- understanding health and safety issues
- reflecting on and evaluating quality of own learning and achievement.

Course providers are encouraged to design programmes which enable learners to develop core skills.
1 Module Title  Engineering Workshop Theory

2 Module Code  C20167

3 Level  5

4 Credit Value  1 credit

5 Purpose  This module is a statement of the standards to be achieved to gain a FETAC credit in Engineering Workshop Theory at Level 5. This module is designed to introduce the learner to the theory associated with engineering workshop processes and practice. The module can be integrated with Engineering Workshop Processes (C20019).

6 Preferred Entry Level  Level 4 Certificate, Leaving Certificate or equivalent qualifications and/or relevant life and work experiences.

7 Special Requirements  None.

8 General Aims  

Learners who successfully complete this module will:

8.1 understand the properties of engineering materials
8.2 be aware of the common machining methods
8.3 describe common engineering joining processes
8.4 become familiar with CNC programming
8.5 become familiar with the common measuring techniques and inspection methods used in an engineering workshop
8.6 understand the need for safety and safe working practices in an engineering workshop environment.

9 Units  The specific learning outcomes are grouped into 5 units.

Unit 1  Properties of Engineering Materials
Unit 2  Engineering Machining Processes
Unit 3  Joining Processes
Unit 4  CNC Programming
Unit 5  Inspection and Measurement
10 Specific Learning Outcomes

Unit 1 Properties of Engineering Materials

Learners should be able to:

10.1.1 list the properties and applications for the following:
• plain carbon and alloy steels
• the cast irons
• copper and its alloys
• aluminium and its alloys
• lead and its alloys

10.1.2 list the properties and applications of the common polymers to include:
• polythene
• pvc
• polystyrene
• polypropylene
• polyurethane
• nylon

10.1.3 list the characteristics and applications of common ceramics

10.1.4 list the properties of cutting fluids and coolants

10.1.5 list the properties and composition of cutting tool materials.

Unit 2 Engineering Machining Processes

TURNING

Learners should be able to:

10.2.1 describe the construction of the main components of the centre lathe to include:
• headstock
• tailstock
• bed
• saddle
• 3 jaw chuck

10.2.2 calculate cutting speeds and feeds, tailstock offsets for taper turning

10.2.3 describe the main angles of lathe cutting tools

10.2.4 explain the effect of variation of the angles describe in 10.2.3 on operation of the cutting process
10.2.5 describe the function and operation of fixed and travelling steadies

10.2.6 outline safe working practices that should be followed when turning

**Milling**

*Learners should be able to:*

10.2.7 describe the construction of the principal types of milling machines:
- horizontal
- vertical
- universal
- turret

10.2.8 describe the principal types of milling cutters

10.2.9 describe the upcut and downcut milling processes

10.2.10 describe the principal methods of *work holding*

10.2.11 describe the construction and operation of the following:
- dividing head
- rotary head

10.2.12 describe how to test a milling machine set up for accuracy

10.2.13 outline safe working practices that should be followed when milling

**Grinding**

*Learners should be able to:*

10.2.14 describe the principal grinding processes to include:
- cylindrical
- surface
- centreless

10.2.15 describe and explain the principal attributes of grinding wheels to include:
- abrasive type
- grain size
- grade
- structure
- bond type

10.2.16 describe the method for testing and safe mounting for grinding wheels

10.2.17 outline safe working practices that should be followed when grinding
DRILLING

Learners should be able to:

10.2.18 describe the construction of drilling machines to include:
- bench
- pillar
- radial
- portable

10.2.19 describe drilling bits to include:
- parallel
- shank
- morse taper

10.2.20 differentiate between hand and machine reamer
10.2.21 calculate drill speeds and feeds
10.2.22 describe methods of work holding
10.2.23 outline safe working practices that should be followed when drilling.

Unit 3 Joining Processes

Learners should be able to:

10.3.1 describe the principle of joining using mechanical fasteners
10.3.2 name the different fusion welding processes
10.3.3 outline safe working practices that should be followed when welding, brazing or soldering

ARC WELDING

Learners should be able to:

10.3.4 describe the arc welding processes, MMA, MAGS, TAGS
10.3.5 describe the power sources used in arc welding
10.3.6 describe and explain the function of the fluxes used in the welding processes

GAS WELDING

Learners should be able to:

10.3.7 describe the oxy-acetylene flame and method of adjustment
10.3.8 describe the equipment used in the gas welding process
BRAZING AND SOLDERING

Learners should be able to:

10.3.9 distinguish between brazing and soldering
10.3.10 list the common fluxes used in brazing and soldering
10.3.11 list the heating methods used in the soldering and brazing processes.

Unit 4 CNC Programming

Learners should be able to:

10.4.1 write programs using G Codes to include the following:
   • facing off
   • parallel turning
   • short tapers
   • radii
   • parting off
10.4.2 outline the concept of canned cycles
10.4.3 differentiate between incremental and absolute programming.

Unit 5 Inspection and Measurement

Learners should be able to:

10.5.1 describe the construction and method of operation of the following:
   • micrometer screw guage
   • vernier calipers
   • vernier height gauge
10.5.2 describe the use and care of the following:
   • slip gauges
   • precision balls and rollers
10.5.3 describe the ISO system of limits and fits
10.5.4 describe the principle of operation of go and not go gauges
10.5.5 measure angles using a sine bar
10.5.6 measure surface roughness.
11 Portfolio of Assessment

Please refer to the glossary of assessment techniques and the note on assessment principles at the end of this module descriptor.

All assessment is carried out in accordance with FETAC regulations.

Assessment is devised by the internal assessor, with external moderation by FETAC.

Summary

<table>
<thead>
<tr>
<th>Assignments (2)</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination (Theory-Based)</td>
<td>50%</td>
</tr>
</tbody>
</table>

11.1 Assignments (2)

The internal 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.

For each assignment, candidates will carry out an investigation of a topic that demonstrates an understanding and application of concepts in engineering workshop theory. Candidates will use appropriate research methods, analyse the findings and present conclusions and recommendations.

The assignments may be presented in a variety of media, for example written, audio, video, graphic, visual or any combination of these. Any audio or video evidence must be provided on tape.

Both assignments carry equal marks.

11.2 Examination

The internal assessor will devise a theory-based examination that assesses candidates’ ability to recall and apply theory and understanding, requiring responses to a range of short answer and structured questions. These questions may be answered in different media such as in writing or orally.

The examination will be based on a range of specific learning outcomes and will be 2 hours in duration.

The format of the examination will be as follows:

Section A
12 short answer questions. Candidates are required to answer 10 (4 marks each).

Section B
4 structured questions. Candidates are required to answer 3 (20 marks each).

12 Grading

Pass 50 - 64%
Merit 65 - 79%
Distinction 80 - 100%
# Engineering Workshop Theory
C20167
Assignments (2) 50%

## Individual Candidate Marking Sheet 1

Candidate Name: ______________________________  PPSN: __________________________
Centre: _________________________________________________  Centre No.: ___________

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Maximum Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>• appropriate methodology including careful observations and recording of relevant information</td>
<td>10</td>
</tr>
<tr>
<td>• comprehensive interpretation and analysis of information</td>
<td>10</td>
</tr>
<tr>
<td>• logical conclusions/recommendations</td>
<td>10</td>
</tr>
<tr>
<td>• clear demonstration of understanding and application of concepts in engineering workshop theory</td>
<td>15</td>
</tr>
<tr>
<td>• appropriate supporting documentation</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Assignment 1</th>
<th>Assignment 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtotal</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL MARKS</strong></td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

*This mark should be transferred to the Module Results Summary Sheet*

Internal Assessor’s Signature: ____________________________  Date: ____________

External Authenticator’s Signature: ____________________________  Date: ____________
Candidate Name: ____________________________ PPSN: _______________________

Centre: __________________________________________________ Centre No.: _________

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Maximum Mark</th>
<th>Candidate Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Section A: Short Answer Questions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 short answer questions, answer 10 (4 marks each)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Indicate questions answered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question No.:* 1</td>
<td>4</td>
<td>4</td>
</tr>
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<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Subtotal</td>
<td>40</td>
<td></td>
</tr>
</tbody>
</table>

| **Section B: Structured Questions**    |              |                |
| 4 structured questions, answer 3 (20 marks each) |              |                |
| (Indicate questions answered)           |              |                |
| Question No.:* 1                       | 20           | 20             |
|                                         | 20           | 20             |
|                                         |              |                |
| Subtotal                                | 60           |                |
| TOTAL MARKS                              | 100          |                |

* The internal assessor is required to enter here the question numbers answered by the candidate.

Internal Assessor’s Signature: ____________________________ Date: __________

External Authenticator’s Signature: ____________________________ Date: __________
## FETAC Module Results Summary Sheet

**Module Title:** Engineering Workshop Theory  
**Module Code:** C20167

<table>
<thead>
<tr>
<th>Candidate Surname</th>
<th>Candidate Forename</th>
<th>Mark Sheet 1</th>
<th>Mark Sheet 2</th>
<th>Total Marks</th>
<th>Grade*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100</td>
<td>100</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

**Maximum Marks per Marking Sheet**

<table>
<thead>
<tr>
<th>Mark Sheet 1</th>
<th>Mark Sheet 2</th>
<th>Total Marks</th>
<th>Grade*</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>100</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

This sheet is for internal assessors to record the overall marks of individual candidates. It should be retained in the centre. The marks awarded should be transferred to the official FETAC Module Results Sheet issued to centres before the visit of the external Authenticator.

**Grade**

- D: 80 - 100%
- M: 65 - 79%
- P: 50 - 64%
- U: 0 - 49%
- W: candidates entered who did not present for assessment
<table>
<thead>
<tr>
<th><strong>Glossary of Assessment Techniques</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assignment</strong></td>
<td><em>An exercise carried out in response to a brief with specific guidelines and usually of short duration.</em></td>
</tr>
<tr>
<td>Each assignment is based on a brief provided by the internal assessor. The brief includes specific guidelines for candidates. The assignment is carried out over a period of time specified by the internal assessor. Assignment may be specified as an oral presentation, case study, observations, or have a detailed title such as audition piece, health fitness plan or vocational area profile.</td>
<td></td>
</tr>
<tr>
<td><strong>Collection of Work</strong></td>
<td><em>A collection and/or selection of pieces of work produced by candidates over a period of time that demonstrates the mastery of skills.</em></td>
</tr>
<tr>
<td>Using guidelines provided by the internal assessor, candidates compile a collection of their own work. The collection of work demonstrates evidence of a range of specific learning outcomes or skills. The evidence may be produced in a range of conditions, such as in the learning environment, in a role play exercise, or in real-life/work situations. This body of work may be self-generated rather than carried out in response to a specific assignment eg art work, engineering work etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Examination</strong></td>
<td><em>A means of assessing a candidate’s ability to recall and apply skills, knowledge and understanding within a set period of time (time constrained) and under clearly specified conditions.</em></td>
</tr>
<tr>
<td>Examinations may be:</td>
<td></td>
</tr>
<tr>
<td>• practical, assessing the mastery of specified practical skills demonstrated in a set period of time under restricted conditions</td>
<td></td>
</tr>
<tr>
<td>• oral, testing ability to speak effectively in the vernacular or other languages</td>
<td></td>
</tr>
<tr>
<td>• interview-style, assessing learning through verbal questioning, on one-to-one/group basis</td>
<td></td>
</tr>
<tr>
<td>• aural, testing listening and interpretation skills</td>
<td></td>
</tr>
<tr>
<td>• theory-based, assessing the candidate’s ability to recall and apply theory, requiring responses to a range of question types, such as objective, short answer, structured, essay. These questions may be answered in different media such as in writing, orally etc.</td>
<td></td>
</tr>
<tr>
<td><strong>Learner Record</strong></td>
<td><em>A self-reported record by an individual, in which he/she describes specific learning experiences, activities, responses, skills acquired.</em></td>
</tr>
<tr>
<td>Candidates compile a personal logbook/journal/diary/daily diary/record/laboratory notebook/sketch book. The logbook/journal/diary/daily diary/record/laboratory notebook/sketch book should cover specified aspects of the learner’s experience.</td>
<td></td>
</tr>
</tbody>
</table>
**Project**

*A substantial individual or group response to a brief with guidelines, usually carried out over a period of time.*

Projects may involve:

- research – requiring individual/group investigation of a topic
- process – eg design, performance, production of an artefact/event

Projects will be based on a brief provided by the internal assessor or negotiated by the candidate with the internal assessor. The brief will include broad guidelines for the candidate. The work will be carried out over a specified period of time.

Projects may be undertaken as a group or collaborative project, however the individual contribution of each candidate must be clearly identified.

The project will enable the candidate to demonstrate: (*some of these – about 2-4*)

- understanding and application of concepts in (specify area)
- use/selection of relevant research/survey techniques, sources of information, referencing, bibliography
- ability to analyse, evaluate, draw conclusions, make recommendations
- understanding of process/planning implementation and review skills/planning and time management skills
- ability to implement/produce/make/construct/perform
- mastery of tools and techniques
- design/creativity/problem-solving/evaluation skills
- presentation/display skills
- team working/co-operation/participation skills.

**Skills Demonstration**

*Assessment of mastery of specified practical, organisational and/or interpersonal skills.*

These skills are assessed at any time throughout the learning process by the internal assessor/another qualified person in the centre for whom the candidate undertakes relevant tasks.

The skills may be demonstrated in a range of conditions, such as in the learning environment, in a role-play exercise, or in a real-life/work situations.

The candidate may submit a written report/supporting documentation as part of the assessment.

Examples of skills: laboratory skills, computer skills, coaching skills, interpersonal skills.
FETAC Assessment Principles

1. Assessment is regarded as an integral part of the learning process.

2. All FETAC assessment is criterion referenced. Each assessment technique has **assessment criteria** which detail the range of marks to be awarded for specific standards of knowledge, skills and competence demonstrated by candidates.

3. The mode of assessment is generally local i.e. the assessment techniques are devised and implemented by internal assessors in centres.

4. Assessment techniques in FETAC modules are valid in that they test a range of appropriate learning outcomes.

5. The reliability of assessment techniques is facilitated by providing support for assessors.

6. Arising from an extensive consultation process, each FETAC module describes what is considered to be an optimum approach to assessment. When the necessary procedures are in place, it will be possible for assessors to use other forms of assessment, provided they are demonstrated to be valid and reliable.

7. To enable all learners to demonstrate that they have reached the required standard, candidate evidence may be submitted in written, oral, visual, multimedia or other format as appropriate to the learning outcomes.

8. Assessment of a number of modules may be integrated, provided the separate criteria for each module are met.

9. Group or team work may form part of the assessment of a module, provided each candidate’s achievement is separately assessed.