Module Descriptor

Motor Vehicle Theory

Level 2 C20114

September 2001

www.ncva.ie
**Level 2 Module Descriptor**

**Summary of Contents**

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<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.ncva.ie">www.ncva.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 Foundation to Level 3.</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>
</tr>
<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 the NCVA approach to assessment.</td>
</tr>
</tbody>
</table>
Introduction

A module is a statement of the standards to be achieved to gain an NCVA 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 the NCVA 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.
Module Title: Motor Vehicle Theory

Module Code: C20114

Level: 2

Credit Value: 1 credit

Purpose: This module provides the necessary mechanical background knowledge to complement unit 1 of the Motor Vehicle Practice (C20044) module. It introduces the learner to the various mechanical components of a motor vehicle.

This is a mandatory module on the National Vocational Certificate Transport Technology Level 2 award.

Preferred Entry Level: National Vocational Certificate Level 1, Leaving Certificate or equivalent qualifications and/or relevant life and work experiences.

Special Requirements: None.

General Aims: Learners who successfully complete this module will:

8.1 understand the workings of the main mechanical components and systems of a motor vehicle

8.2 dismantle and reassemble a variety of components of a motor vehicle

8.3 use a wide range of tools correctly and maintain them

8.4 appreciate the need to maintain a motor vehicle properly

8.5 develop safe working practices when working on a motor vehicle

8.6 be aware of modern developments in the motor vehicle.
9 Units

The specific learning outcomes are grouped into 8 units.

Unit 1 Power Unit
Unit 2 Combustion System
Unit 3 Lubrication
Unit 4 Cooling System
Unit 5 Transmission System
Unit 6 Brakes and Steering
Unit 7 Tyres and Suspension
Unit 8 Health and Safety

10 Specific Learning Outcomes

Unit 1 Power Unit

Learners should be able to:

10.1.1 explain how an engine acts as an energy converter
10.1.2 explain the role of the cylinder in the energy conversion process
10.1.3 describe, with the aid of a diagram, the combustion process in a cylinder
10.1.4 describe, with the aid of diagrams, the 4-stroke cycle
10.1.5 describe, with the aid of diagrams, the 2-stroke cycle
10.1.6 describe, with the aid of diagrams, the 4-stroke compression-ignition system
10.1.7 explain the function of each component involved in these cycles (i.e. piston, rings, valves, camshafts etc.)
10.1.8 explain the following terms: piston slap, offset piston
10.1.9 discuss the major-minor thrust forces involved in these cycles
10.1.10 differentiate between OHC and push rod engines
10.1.11 list the advantages of OHC engines over push rod engines
10.1.12 list the advantages of using multiple cylinders
10.1.13 explain the need for different engine arrangements
explain the role of the crankshaft under the following headings:
- converting reciprocal motion to rotary
- firing order
- valve and piston operation
- transmits power via flywheel to the transmission system

explain the role of poppet valves in the combustion process

outline how poppet valves are operated by the camshaft, tappets, spring

describe and illustrate the different valve arrangements

list the advantages associated with these valve arrangements

explain the need for valve timing and how it is achieved

explain the relationship between the components that control valve timing

dismantle and assemble the main parts of a power unit.

**Unit 2  Combustion System**

*Learners should be able to:*

outline the principle of carburation

explain how a carburettor functions

distinguish between the two main types of carburettor
- fixed jet
- variable jet

explain the basic working principles of these two types of carburettor

list the advantages associated with each type of carburettor

explain the role of a choke for a cold-start

explain how the fuel/air ratio is adjusted in a basic carburettor

explain the role of the air filter in the supply of air to the carburettor

explain the octane rating of a fuel

outline the role of additives in fuels
10.2.11 describe the different methods of supplying fuel to the carburettor
10.2.12 outline the operation of a fuel pump
10.2.13 list the advantages and disadvantages of electrical and mechanical fuel pumps in relation to safety
10.2.14 sketch and label an exhaust system
10.2.15 outline how exhaust emissions are controlled
10.2.16 outline the role of a gas analyser
10.2.17 discuss the working principle of an injector
10.2.18 compare and contrast the compression/ignition system with the spark ignition system
10.2.19 assemble a carburation system from discrete components.

Unit 3  
**Lubrication**

*Learners should be able to:*

10.3.1 explain the need for lubrication
10.3.2 explain the terms: viscosity, friction
10.3.3 explain the need for additives to control viscosity under different conditions
10.3.4 indicate on a diagram the main components of a lubrication system, indicating the direction of the oil flow
10.3.5 dismantle and reassemble a lubrication system for a motor vehicle
10.3.6 describe the different methods of lubricating moving parts
10.3.7 sketch and label the cross-section of a cartridge-type oil filter
10.3.8 explain how impurities are trapped in an oil filter.
Unit 4  Cooling System

*Learners should be able to:*

10.4.1 explain the need for cooling an engine and how it is achieved

10.4.2 explain the function of the following components of a liquid-cooled engine:
- radiator
- radiator cap
- thermostat
- pump
- cooling fan
- drive/fan belt
- heater radiator

10.4.3 compare and contrast an air-cooled with a liquid-cooled engine

10.4.4 explain how engine efficiency is achieved by regulating engine temperature

10.4.5 explain the role of additives in the cooling system

10.4.6 differentiate between a sealed and a vented system

10.4.7 state the reasons for using different thermostat settings

10.4.8 assemble a cooling system from discrete components.

Unit 5  Transmission System

*Learners should be able to:*

10.5.1 outline the role of friction in the operation of a clutch

10.5.2 sketch a clutch arrangement

10.5.3 describe the operation of a single plate clutch

10.5.4 explain the role of the following components of a single plate clutch
- pressure plate
- driven plate
- release bearing

10.5.5 explain how a clutch is engaged and disengaged

10.5.6 describe the operation of the two different clutch operating systems: hydraulic, mechanical
10.5.7 explain the purpose of a gearbox

10.5.8 outline the working principle of a gearbox

10.5.9 outline how gear ratios are achieved

10.5.10 discuss the effects of changing gears

10.5.11 explain the need for gearbox oil

10.5.12 explain the role of propeller shafts and drive shafts in transmitting drive to the road wheels

10.5.13 outline the role of CV joints in transmitting drive to the front road wheels

10.5.14 explain the role of the differential in the final drive

10.5.15 discuss the various ways of achieving transmission without using a propeller shaft

10.5.16 list the advantages of 4-wheel drive.

Unit 6 Brakes and Steering

Learners should be able to:

10.6.1 explain the role of the braking system in a motor vehicle

10.6.2 explain the term braking distance and list the factors that affect it

10.6.3 differentiate between wheel brake and engine break

10.6.4 discuss the role of friction in the operation of a braking system

10.6.5 explain how heat is dissipated in drum and disc brakes

10.6.6 sketch and label a drum and disc brake arrangement

10.6.7 compare and contrast with the aid of simple diagrams, drum and disc brakes

10.6.8 explain the role of brake fluid in transmitting pressure through the braking system
10.6.9 explain the role of the following components of a hydraulic braking system:
• master cylinder: single and dual type
• reservoir
• servo
• pipelines
• regulators: proportioning valves, load sensing
• wheel cylinder/callipers
• check valves
• parking brake

10.6.10 sketch a handbrake arrangement

10.6.11 explain why brake fluid deteriorates with time and why it must be changed

10.6.12 dismantle and assemble a drum brake arrangement

10.6.13 dismantle and assemble a disc brake arrangement

10.6.14 explain the purpose of steering

10.6.15 discuss the requirements of a steering system

10.6.16 outline the different types of steering configurations

10.6.17 discuss the centrifugal forces involved in steering

10.6.18 describe with the aid of diagrams how the following steering systems operate
• rack and pinion
• recirculating ball type

10.6.19 explain the role or track rods and track rod ends in steering

10.6.20 distinguish between camber and castor (steering inclination)

10.6.21 identify the steering linkage components

10.6.22 explain the need for wheel alignment

10.6.23 outline how safety features are incorporated into a steering column

10.6.24 discuss the impact absorbing mechanisms, tilt mechanism and locking system in the steering column

10.6.25 explain the basic principle of power steering.
Unit 7  Tyres and Suspension

Learners should be able to:

10.7.1 outline different techniques used in vehicle suspension e.g. steel springs, rubber springing, pneumatic

10.7.2 explain the need for suspension

10.7.3 outline the different types of suspension

10.7.4 sketch the various types of springs:
  • leaf
  • coil
  • torsion bar

10.7.5 list the applications and the characteristics of each type of leaf spring

10.7.6 discuss the need for and the purpose of suspension damping

10.7.7 explain with the aid of a diagram, the basic operation of a hydraulic damper

10.7.8 sketch and label a McPherson strut assembly

10.7.9 sketch and label a trailing arm design assembly

10.7.10 sketch the cross-section through an inflated tyre and wheel, indicating
  • bead wires
  • beading
  • sidewall
  • tread
  • rim

10.7.11 illustrate the difference between cross-ply and radial-ply tyres

10.7.12 discuss the importance of tread pattern in a tyre

10.7.13 identify the causes of abnormal tyre wear

10.7.14 explain tyre sizes and tyre profiling

10.7.15 outline the function of a valve.
Unit 8  Health and Safety

*Learners should be able to:*

10.8.1 identify the adverse physical, chemical, biological and psychological effect of common hazards on the human body

10.8.2 recognise common hazard symbols and labels

10.8.3 know the rights and responsibilities of employers and employees as specified in the Safety, Health and Welfare at Work Act 1989

10.8.4 follow correct safety procedures when removing components from a motor vehicle

10.8.5 wear appropriate personal protection equipment.

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 NCVA regulations.

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

**Summary**

<table>
<thead>
<tr>
<th>Skills Demonstration</th>
<th>60%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examination (Theory-Based)</td>
<td>40%</td>
</tr>
</tbody>
</table>

11.1  Skills Demonstration

In one or more skills demonstrations, candidates will be assessed in a broad range of practical skills and knowledge while carrying out at least 4 practical tasks, based on a range of specific learning outcomes.

These tasks should be chosen from the following:

1. dismantle and assemble the main parts of a power unit
2. assemble a carburation system from discrete components
3. dismantle and reassemble the lubrication system of a motor vehicle
4. assemble a cooling system from discrete components
5. dismantle and assemble a drum brake arrangement
6. dismantle and assemble a disk brake arrangement.

The candidate will demonstrate adherence to safe working practices throughout the skills demonstration.

The skills can be assessed at any time throughout the learning process.
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 question types, short answer and structured. 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 in Units 1 – 7 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
3 structured questions – not more than 1 question per unit.
Candidates are required to answer 2 (20 marks each).

12 Grading

Pass 50 - 64%
Merit 65 - 79%
Distinction 80 - 100%
<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Maximum Mark</th>
<th>Candidate Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>• appropriate preparation and planning of each task</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>• effective execution of each task demonstrating mastery of tools and techniques</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>• safe use and careful maintenance of tools and equipment</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

### TOTAL MARKS

This mark should be transferred to the Module Results Summary Sheet

| Total Marks | 120 |

Internal Assessor’s Signature: __________________________ Date: __________

External Examiner’s Signature: __________________________ Date: __________
<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 any 10 (4 marks each) (Indicate questions answered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question No.:* _____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td><strong>Section B: structured questions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 structured questions, answer any 2 (20 marks each) (Indicate questions answered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question No.:* _____</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>_____</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>TOTAL MARKS</td>
<td>80</td>
<td></td>
</tr>
</tbody>
</table>

*The internal assessor is required to enter here the question numbers answered by the candidate.*
### NCVA Module Results Summary Sheet

**Module Title:** Motor Vehicle Theory  
**Module Code:** C20114  
**Module Code:** C20114

<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>Total (\div 2)</th>
<th>Grade*</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>120</th>
<th>80</th>
<th>200</th>
<th>100%</th>
<th></th>
</tr>
</thead>
</table>

**Signed:**  
**Internal Assessor:** _____________________________  
**Date:** _____________________________  

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 NCVA Module Results Sheet issued to centres before the visit of the external examiner.

**Grade**  
- **D:** 80 - 100%  
- **M:** 65 - 79%  
- **P:** 50 - 64%  
- **U:** 0 - 49%  
- **W:** candidates entered who did not present for assessment
Glossary of Assessment Techniques

Assignment  
An exercise carried out in response to a brief with specific guidelines and usually of short duration.

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.

Assignments 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.

Collection of Work  
A collection and/or selection of pieces of work produced by candidates over a period of time that demonstrates the mastery of skills.

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.

Examination  
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.

Examinations may be:

- practical, assessing the mastery of specified practical skills demonstrated in a set period of time under restricted conditions
- oral, testing ability to speak effectively in the vernacular or other languages
- interview-style, assessing learning through verbal questioning, on one-to-one/group basis
- aural, testing listening and interpretation skills
- 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.

Learner Record  
A self-reported record by an individual, in which he/she describes specific learning experiences, activities, responses, skills acquired.

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.
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.
NCVA Assessment Principles

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

2. All NCVA 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 NCVA 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 NCVA 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.