Co. Cavan VEC

Programme Module for

Tractor Mechanics

leading to

Level 5 FETAC

Agricultural Mechanics 5N1745

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 Co. Cavan 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 a. Assessment Technique(s) b. Mapping of Learning Outcomes to Assessment Technique(s) c. Guidelines for Assessment Activities
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.

1. Title of Programme Module
Agricultural Mechanics

2. Component Name and Code
Agricultural Mechanics 5N1745

3. Duration in Hours
100 Hours (typical learner effort, to include both directed and self directed learning)

4. Credit Value
10 Credits

5. Status
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

6. Special Requirements
None

7. Aim of the Programme Module
This programme module aims to equip the learner with the knowledge, skills and competence to carry out tractor and workshop tasks in a safe manner.

8. Objectives of the Programme Module

- To explore with the learner the mechanical principles applying to engines, machines, hand and power tools.
- To assist the learner to gain an understanding of the component systems associated with tractor engines in relation to agricultural/horticultural work.
- To facilitate the learner to develop the skills to perform a range of mechanical/electrical maintenance and repair procedures associated with tractors.
- To create an awareness of safe working practices and be aware of the need for health and safety requirements in the workplace.
- To assist the learner to develop the academic and vocational language, literacy and numeracy skills related to Agricultural Mechanics through the medium of the indicative content.
- To enable the learner to take responsibility for his/her own learning.

9. Learning Outcomes of Level 5 Agricultural Mechanics 5N1745

Learners will be able to:

1. Explain mechanical principles applying to engines, machines, hand and power tools including force, torque, pressure, work, power, horsepower, principle of moments, gear and belt speed ratios, centre of gravity and stability.

2. Make comparisons between diesel and petrol engines including combustion, torque, power, fuel consumption and relative advantages and disadvantages of each engine type in agricultural/horticultural work.

3. Describe the component systems associated with tractor engines including cooling, lubrication, fuel, ignition, transmission, hydraulic, power take off, steering, four-wheel drive and braking systems.

4. Appraise the range of fuels and oil and grease lubricants for agricultural use including handling precautions, selection and on farm storage.

5. Use hand and power tools and equipment for nuts and bolts, measuring and marking, cutting and punching, drilling, grinding and welding.

6. Carry out basic electrical maintenance tasks including batteries, carbon brushes, fuses, bulbs, 13 amp plugs and 7 pin trailer plugs.

7. Perform routine 50 hour and 500 hour tractor services in accordance with manufacturers recommendations.

8. Carry out tractor and workshop tasks effectively and in accordance with safety requirements.

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 : Mechanical

Facilitate the learner to:

- Explain the following mechanical principles
  - Force
  - Torque
  - Pressure
  - Work
  - Horsepower
- State and apply the principle of moments
- Define centre of gravity and stability
- Compare and contrast diesel and petrol engines in relation to
  - Internal components
    - Valves
    - Camshaft
    - Pistons
    - Piston rings
    - Connecting rod
    - Crankshaft
    - Timing systems
  - Describe with the aid of diagrams the combustion process of the following
    - 4 stoke cycle petrol & diesel
    - 2 stroke cycle
  - Torque
  - Power
  - Fuel Consumption
- List the advantages and disadvantages of each type of engine in agricultural/horticulture work

Cooling System

Facilitate the learner to:

- Compare and contrast an air cooled with a liquid cooled engine.
- Describe the functions of the main components of an engine cooling system, to include:
  - Thermostat
  - Water pump
  - Radiator
  - Cooling fan

- Radiator cap
- Fan belt
- Temperature sensors
- Heater radiator
- Antifreeze/coolant and corrosion inhibitors

Lubrication system:

Facilitate the learner to:

- Describe the need for a lubrication system, to include
  - Viscosity and viscosity index
  - The need for additives
  - List the types and applications of oil and grease lubricants
  - Describe the different methods of lubricating moving parts
  - Indicate on a diagram the main components of a lubrication system

Fuel System:

Facilitate the learner to:

- Describe the functions of the main components of the fuel system, to include:
  - Fuel Tank
  - Fuel lift pump
  - Fuel Filter & Sediment bowl
  - Injection pump
  - Injectors
  - Stop solenoid

- Appraise the range of fuels for use in agricultural use, to include:
  - Diesel
  - Petrol
  - Alternative fuels

- Explain the need for air filtering and describe
  - a dry air cleaner
  - an oil bath air cleaner

Section 2: Tractor Components

1. Transmission:

Facilitate the learner to:

- Describe the components of a Tractor transmission system, to include:
  - Clutch
    - § Explain the function of a clutch
  - Describe the following types and list their applications
    - § Single clutch
    - § Double clutch

- Describe how to adjust a clutch

- Outline how gear and belt speed ratios are achieved

- Outline with the aid of a diagram the operation of a basic three speed and reverse gearbox.

- Explain the operation of the following types of gearbox
  - Sliding mesh
  - Constant mesh
  - Synchromesh

- Describe the principle of operation of the following
  - Powershifting & Auto Powershifting
  - Hydrostatic gearbox
  - Forward/Reverse shuttle

- Explain the function of:
  - Crown wheel & Pinion
  - Differential
  - Differential lock
  - Final reduction gears

2. Four wheel drive:

Facilitate the learner to:

- Outline the working principle of 4 wheel drive

- List the advantages of 4 wheel drive

- Describe the operation of the following in relation to 4 wheel drive
  - Limited slip differential
  - Headland management system

3. Braking systems:

- Describe with the aid of diagrams operation of a Tractor braking system, to include:
  - Disc brakes, dry & wet
  - Drum brakes

- Discuss the role of pedal locks
  - Handbrake
  - Types of brake fluid

4. Hydraulic:

Facilitate the learner to:

- Identify from a diagram of a basic tractor hydraulic lift system
  - Oil supply

- Filter
- Pump
- Control valves
- Relief valve
- Hydraulic cylinder

- Describe the following control systems:
  - Draft control
    - Top link & lower link sensing
  - Position Control
  - Flow control or response control
  - Mechanical lock
  - Auxiliary hydraulic services

- Discuss the potential dangers associated with high hydraulic pressures

5. Power take of:

Facilitate the learner to:

- Indicate on a diagram the path of drive from the flywheel to power take of point

- Discuss the role of the double clutch when using a PTO

- Explain the operation of the following types of PTO
  - Transmission PTO
  - Live PTO
  - Independent PTO

- Specify the relevant power take of speed and the engine/PTO speed relationship

- List the dangers associated with the power take off shaft and how these can be minimised

6. Steering:

Facilitate the learner to:

- Describe with the aid of diagrams the different types of steering box , to include:
  - Rack and pinion
  - Worm and nut
  - Recirculating ball

- Outline the principle of
  - Power steering
  - Hydrostatic steering

- Explain the need for track alteration

- Interpret tyre markings
- Outline the factors that must be considered when choosing tyres
- List the tyre pressures used for different operations
- Identify the causes of abnormal tyre wear
- Change a tractor wheel

7 Tractor service operations:

- Perform routine 50 hour and 500 hour tractor services in accordance with manufacturers recommendations

Section 3: Workshop Processes

Facilitate the learner to:

- Use of hand and power tools for nuts and bolts
    - Basic hand tools
    - Air guns
    - Electric/ cordless drill
    - Angle grinder
    - Bench grinder
- Use the following measuring tools
    - Vernier callipers
- Use the following marking out tools
    - Rule
    - Scriber
    - Vernier protractor
    - Dividers
    - Centre punch
    - Vernier height gauge
    - Surface plate
    - Vee blocks
- Use the following cutting and filing tools:
    - Snips
    - Guillotine
    - Saw

- Files
- Drill holes using fixed drilling machines
- Correctly fit
  - Parallel shank drill bits
- Secure parts while drilling using
  - Machine vise
  - Clamps
- Change spindle speed
- Demonstrate the following
  - Pilot hole, blind hole, countersunk hole, counter bore,

Welding

Facilitate the learner to:

- Join material using the following methods
  - Manual metal arc welding
    - Butt welding

Section 4: Electrical

Facilitate the learner to:

- Explain the functions of the following components of an electrical ignition system
  - Coil
  - Distributer
  - Contact breaker points
  - Crankshaft sensor
  - Magneto
  - Spark plug
- Indicate on a diagram the components listed above
- Carry out a battery maintenance procedures, to include:
  - Maintaining the correct electrolyte level
  - Cleaning and protecting the terminals
  - Determining the state of charge of the battery
  - Charging a battery
  - Remove and install a battery

- Replace using the correct tools electrical components to include
  - Starter
  - Alternator
  - Carbon brushes in starters and alternators
  - Fuses
  - Bulbs
- Wire a 13 amp plug correctly
- Wire a 7-pin trailer plug correctly

Section 5: Health and Safety

Facilitate the learner to:

- Follow correct safety procedures when working on tractors, either in the workshop or on site.
- Select and wear appropriate personal protective equipment.
- Recognise common hazards associated with tractor maintenance, to include:
  - Hazard symbols
  - Handling precautions
  - On-farm storage
  - Correct disposal of waste products
- Identify the adverse physical, chemical, biological and physiological effects of common hazards on the human body.

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

11. Assessment

11a. Assessment Techniques

Skills demonstration 60%

Examination Theory 40%

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.

Learning Outcome	**Assessment Technique**
1. Explain mechanical principles applying to engines, machines, hand and power tools including force, torque, pressure, work, power, horsepower, principle of moments, gear and belt speed ratios, centre of gravity and stability.	Theory Examination
2. Make comparisons between diesel and petrol engines including combustion, torque, power, fuel consumption and relative advantages and disadvantages of each engine type in agricultural/ horticultural work.	Theory Examination
3. Describe the component systems associated with tractor engines including cooling, lubrication, fuel, ignition, transmission, hydraulic, power take off, steering, four-wheel drive and braking systems.	Theory Examination/ Skills Demonstration
4. Appraise the range of fuels and oil and grease lubricants for agricultural use including handling precautions, selection and on farm storage.	Theory Examination
5. Use hand and power tools and equipment for nuts and bolts, measuring and marking, cutting and punching, drilling, grinding and welding	Skills demonstration
6. Carry out basic electrical maintenance tasks including batteries, carbon brushes, fuses, bulbs, 13 amp plugs and 7 pin trailer plugs.	Skills demonstration/ Theory Examination
7. Perform routine 50 hour and 500 hour tractor services in accordance with manufacturer's recommendations.	Skills demonstration
8. Carry out tractor and workshop tasks effectively and in accordance with safety requirements.	Skills demonstration/ Theory Examination

11c. Guidelines for Assessment Activities

The assessor is required to devise assessment briefs and marking schemes for the skills demonstration and an examination paper, marking scheme and outline solutions for the Theory Examination.

In devising the assessment briefs and examination papers, 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.

Skills Demonstration	60%
The learner must complete 20 tasks from a specified list based on a range of learning outcomes. The skills can be assessed at any time throughout the learning process	

A skills demonstration is used to assess a wide range of practical based learning outcomes including practical skills and knowledge. A skills demonstration will require the learner to complete a task or series of tasks that demonstrate a range of skills.

The assessor will devise a skills demonstration based on learning outcomes 5-8 and 3.
The learner must complete the 20 tasks set out in the list below.
The skills demonstration will be terminated if learner commits a critical fault during the task.

Weighting Factor:

Where a critical fault occurs the entire skills demonstration must be terminated.
0 mark for termination of skill demonstration due to a critical fault or failure to complete the task.
1 mark for completing the task with 3 or more minor faults
2 marks for completing the task with less than 3 minor faults
3 marks for exceeding the criteria for the task with no minor faults

Examples of critical faults: compromises safety, animal welfare, the environment

Examples of minor faults: Incorrect sequence, too slow, requires guidance

The learner must achieve at least 40 of the 60 marks available, to pass this assessment.
The learner must pass this assessment to achieve the award.

List of skills:

1 Remove machine component and refit with fasteners correctly torqued
2 Manufacture a piece of steel work to given specifications involving 8 tasks (marking, measuring, cutting, filing, punching, drilling, grinding and butt welding)
3 Service electrical systems
4 Wire 13 amp
5 Wire 7-pin trailer plugs
6 Perform 4 tasks from 50 hour service tasks (nominated by tutor)
7 Perform 4 tasks from 500 hour service tasks (nominated by tutor)

Overall Marks 60

Evidence for this assessment technique may take the form of the finished practical task / written, oral evidence and the tutor devised skills demonstration marking sheet. All instructions for the learner must be clearly outlined in an practical assessment brief

Theory Examination	**40%**
The assessor will devise a theory-based examination that assesses the Learners ability to recall and apply theory and understanding, requiring responses to a range of short answer and structured questions. The format of the examination will be as follows:	
The assessor will devise a theory based examination to assess learning outcomes 1-4 and 8 And will be 2 hours in duration. The format of the examination will be as follows: **Section A: Short Questions** 12 short questions Learners are required to answer 10 (2 marks each) **Section B: Structured Questions** 3 structured questions Learners are required to answer 2 (10 marks each) Overall marks 40 Evidence for this assessment technique may take the form of written, oral evidence. Any audio, video or digital evidence must be provided in a suitable format. 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.

Agricultural Mechanics 5N1745	Learner Marking Sheet Skills Demonstration 60%

Learner's Name: _____ Learner's PPSN: _____

Assessment Criteria	Maximum Mark	Learner Mark
Remove machine component and refit with fasteners correctly torqued	3	
Manufacture a piece of steel work to given specifications involving 8 tasks. marking, measuring, cutting, filing, punching, drilling, grinding and butt welding.	24	
Service Electrical Systems	3	
Wire a 13 amp plug	3	
Wire a 7-pin trailer plug	3	
Perform 4 tasks from 50 hour service tasks	12	
Perform 4 tasks from 500 hour service tasks	12	
Total Mark	60	

Assessor's Signature: _____ Date: _____

External Authenticator's Signature: _____ Date: _____

Agricultural Mechanics 5N1745	Learner Marking Sheet Theory Examination 40%

Learner's Name: _____ Learner's PPSN: _____

Assessment Criteria	Maximum Mark	Learner Mark
Section A: Short answer questions 12 short answer questions Learners are required to answer 10 (2 marks each) (Indicate questions answered) Question No.:* _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	2 2 2 2 2 2 2 2 2 2	
Subtotal	20	
Section B: Structured Questions 3 Structured questions Learners are required to answer 2 (10 marks each) (Indicate questions answered) Question No.:* _____ _____	10 10	
Subtotal	20	
Total Mark	40	

Assessor's Signature: _____ Date: _____

External Authenticator's Signature: _____ Date: _____