

Course Unit	Mechanization and Equipment	Field of study	Engineering and Related Technics
Bachelor in	Agronomic Engineering	School	School of Agriculture
Academic Year	2023/2024	Year of study	1
Type	Semestral	Semester	2
Level	1-1	ECTS credits	6.0
Code	9086-813-1203-00-23		
Workload (hours)	162	Contact hours	T - TP - PL - TC - S - E - OT - O -

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) **Arlindo Castro Ferreira Almeida**

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. To know the agricultural and forestry tractors, how they work and the processes involved in their performance.
2. To know agricultural and forestry machinery and related farming operations.
3. To identify problems that can jeopardize machines performance and define solutions.
4. To know the mutual tractor/operating machine influence.
5. To plan the use of equipment, taking into account safety conditions and risk prevention.
6. To know methods of precision farming.
7. To understand technical information contained in engines tractors test reports and performance curves.
8. To choose equipment considering the economic conditions and natural resources conservation. To know methods to evaluate machines field work capacity and costs.

### Prerequisites

Before the course unit the learner is expected to be able to:

1. Know basic physics concepts: work, force, power, torque, thermodynamics.
2. Know physic soils characteristics.
3. Know basic elements of economics and management.

### Course contents

Engine cycles: Otto and Diesel. Four stroke cycle and dual cycle. Torque, power, consumption. Agriculture tractors performance. Operating machines in agriculture: soil tillage, crop planting, chemical application, hay and forage harvesting, grain harvesting, fruit, nut and vegetable harvesting, conveying of agricultural materials. Use of agriculture equipment in precision farming. Safety in agriculture equipment work. Machinery management.

### Course contents (extended version)

1. Engines.
  - Fundamentals of engines.
  - Otto and Diesel cycles. Four stroke cycle and dual cycle technology.
  - Distribution, starting system, cooling systems, lubrication systems, turbocharged engines.
  - Fuels and lubricants.
  - Torque, power and consumption.
2. Tractors.
  - Main types.
  - Transmission.
  - Steering systems and brake systems.
  - Linkage systems tractors/implements.
  - Tractor electric system.
  - Weels and tracks.
  - Performance: traction ratio, slippage, rolling resistance.
  - Safety conditions.
3. Agriculture field work machanization.
  - Soil tillage.
  - Fertilizer distributors, seeders and crop planters.
  - Equipment for phytosanitary products application.
  - Hay and forage harvesting, grain harvesting, fruit, nut and vegetable harvesting.
4. Precision farming techniques in mechanized agriculture activities.
  - Artificial Intelligence (AI) in agriculture.
  - Use of VRT equipment (variable rate technology) applying agriculture inputs.
  - GPS support systems for driving tractors.
5. Agriculture equipment costs.
  - Equipment performance.
  - Costs per time unit and per area unit.
  - Joint use of agricultural equipment.
  - Selection of agricultural equipment.
  - Machinery management.

### Recommended reading

1. Elorza, Pilar Barreiro et al, 2012. Las Maquinas Agrícolas Y Su Aplicación, Mundi-Prensa, Madrid.
2. HIDALGO, L. y J. Hidalgo, 2001. Ingeniería y Mecanización Vitícola, Ediciones Mundi-Prensa, Madrid
3. Márquez, Luis, 2012. Tractores Agrícolas : Tecnología Y Utilización, B&H Editores, Madrid.
4. ORTIZ-CANAVATE, 2005 Tractores Técnica y Seguridad, Ediciones Mundi-Prensa, Madrid
5. Stafford, J. V. (ed). 2007. Precision agriculture 07. Wageningen Academic Publishers. Netherlands.

### Teaching and learning methods

Lectures and solving problems. Applied field work using ESA agriculture equipment.

### Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final, Supplementary)

**Assessment methods**

- Intermediate Written Test - 50% (Interim written test (50%))
- Final Written Exam - 50% (Final written exam (50%))
- 2. Alternative 2 - (Student Worker) (Final, Supplementary, Special)
  - Final Written Exam - 100%
- 3. Alternative 3 - (Regular) (Special)
  - Final Written Exam - 100%

**Language of instruction**

Portuguese, with additional English support for foreign students.

**Electronic validation**

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22-01-2024	22-01-2024	23-01-2024	23-01-2024