
DEGREE CURRICULUM

# BASICS OF RURAL ENGINEERING

Coordination: MONSERRAT VISCARRI, JOAQUIM

Academic year 2020-21

# BASICS OF RURAL ENGINEERING 2020-21

## Subject's general information

| | |
|---|---|
| **Subject name** | BASICS OF RURAL ENGINEERING |
| **Code** | 102527 |
| **Semester** | 2nd Q(SEMESTER) CONTINUED EVALUATION |
| **Typology** | Degree: Bachelor's Degree in Agricultural and Food Engineering; Course: 2; Character: COMPULSORY; Modality: Attendance-based |
| **Course number of credits (ECTS)** | 9 |
| **Type of activity, credits, and groups** | Activity type: PRALAB / PRAULA / TEORIA<br>Number of credits: 0.4 / 0.6 / 3.2 / 4.8<br>Number of groups: 6 / 2 / 1 / 1 |
| **Coordination** | MONSERRAT VISCARRI, JOAQUIM |
| **Department** | AGRICULTURAL AND FOREST ENGINEERING |
| **Teaching load distribution between lectures and independent student work** | Presential hours: 90<br>Non-presential hours: 135 |
| **Important information on data processing** | Consult this link for more information. |
| **Language** | Catalan: 67%<br>Spanish: 33% |

# BASICS OF RURAL ENGINEERING 2020-21

| Teaching staff | E-mail addresses | Credits taught by teacher | Office and hour of attention |
|---|---|---|---|
| ARNÓ SATORRA, JAIME | jaume.arno@udl.cat | 1,4 | |
| COTS RUBIÓ, LLUÍS | lluis.cots@udl.cat | 1,2 | |
| LAVAQUIOL COLELL, BERNAT | bernat.lavaquiol@udl.cat | 1,2 | |
| MONSERRAT VISCARRI, JOAQUIM | joaquim.monserrat@udl.cat | 4,2 | |
| ROSELL POLO, JOAN RAMON | joanramon.rosell@udl.cat | 3,6 | |

## Subject's extra information

**Subject in the whole curriculum**

This subject, located in the second year and the second semester, acts as a bridge between the basic subject Physics and the specific engineering (electrical engineering, machinery and irrigation) of each orientation.

**Requirements to take it**

Have studied Physics I, Physics II

**Regulations**

Voice and image recording during the course of classes with any medium is strictly prohibited.
Mobile phones, digital clocks, tablets and computers will remain switched off until the teacher indicates otherwise to carry out any activity in the classroom that requires it. In the exams, they are totally forbidden.

## Learning objectives

**BLOCK I Hydraulic Engineering**

1. Analyze and desig simple pipes and canals

2. Analyze pressure networks
3. Know the characteristic curves of the centrifugal pumps.  how to select a pump for given conditions.

**BLOCK II Electrical engineering**

1. To base the foundations for knowing and using the regulations and electrical equipment that future graduates can find in their professional activity, especially when carrying out an electrification project in the agroforestry field.

2. Acquire the basic knowledge about alternating current and, more specifically, monophasic systems necessary to solve any electrical system in Engineering.

3. Know the basics of three-phase systems and resolution of symmetrical circuits.

4. Acquire the basics for the electrical calculation of medium and low voltage networks, which are the ones that appear most regularly in the agroforestry field.

Block III Machine Engineering

1. Know the basic characteristics of the engines that equip the different agricultural machines and know how to select and compare the most important parameters.

2. Know the operation and benefits of air groups (fans).

3. Know the main mechanical transmission systems of the power in the machinery.

4. Know the design bases of different mechanisms and machine elements: clutches, mechanical transmissions with flexible elements, gearboxes and gearboxes and multipliers and gearboxes.

5. Know the basic principles of hydrostatic power transmission systems.

6. Know the bases of design of hydraulic circuits in agricultural machines and the procedures for the selection of components: fluids, pumps, actuators and elements of regulation and control.

In addition, the student must have obtained the CAPACITIES (COMPETENCES) that allow him:

7. Select the basic characteristics of combustion engines, both ignition and compression ignition (diesel).

8. Interpret the characteristic curves of a diesel engine and determine its optimum operating point.

9. Design and select mechanical elements for the transmission of power: friction clutches, torque limiters, gears, belts and transmission chains.

10. Select components for circuits and hydraulic transmissions: pumps, actuators, regulation and control elements and auxiliary elements.

## Competences

**General competences**

CG2. Adequate knowledge of physical problems, technologies, machinery and water and energy supply systems, the limits imposed by budgetary factors and construction regulations, and the relationships between facilities or buildings and farms, agri-food industries and areas related to gardening and landscaping with their social and environmental environment, as well as the need to relate those and this environment to human needs and the preservation of the environment.

CG7. Knowledge of basic, scientific and technological subjects that allow continuous learning, as well as an ability to adapt to new situations or changing environments.

CG8. Ability to solve problems with initiative and creative proposals, methodology and using critical reasoning.

CG10. Ability to research and use the rules and regulations relating to their field of action.

**Specific competences**

CEFB5. Understanding and mastery of the basic concepts of the general laws of mechanics, thermodynamics, fields, and waves and electromagnetism and their application for solving problems specific to engineering.

CEMC7. Rural engineering: structure and construction calculation, hydraulics, motors and machines, electrical engineering, technical projects

## Subject contents

Given that this subject presents, in its competitions, a great variation in the different fields of engineering, it is necessary to structure it in three independent blocks, so much so that the matter is studied as with the time it will be taught.

These blogs are:

Block 1 Hydraulic Engineering.
Block 2 Electrical engineering.
Block 3 Machine Engineering.

**BLOCK I Hydraulic Engineering**

**Unit 1**.- Reminder Properties of liquids and fundamental equations.

**Unit 2**.- Flow in pressure conduits.

- No. of Reynolds. Laminate and turbulent flow in pipes. Limit layer Ruggedness in pipes.

- Continuous burden losses: Darcy-Weisbach formula. Determination of the friction factor:

Moody's abacus; Logarithmic formulas Monomic formulas

- Loads of localized load: losses in sections narrowings, elbows valves. Equivalent length of a conduction.

- Characteristic curve of a pipe. Serial and parallel connection: graphical and numerical method. Examples. Calculation of branched networks.

- Representation of power lines and piezometric lines. Siphon: determination of the flow and maximum height.

- The accumulation of air in the pipes. Depressions and overpressions. Solutions: suction cups, increase diameters, chimneys.

**Unit 3**.- Flow in open conduits: channels.

- Permanent and uniform regime. Types of regime in channels. Forms to determine the load losses: Chezy, Manning, Bazin.

- Pipe comparison - channel

**Unit 4**.- Impulsions.

- Generalities on centrifugal pumps: Parts of a centrifugal pump.

- Characteristic curves of a pump: manometric height-flow, power-flow rate, flow-rate flow and N.P.S.H. Cavitation - Association of pumps in series and in parallel: Graphic method i

Numerical Operating point of an installation. Pump selection criteria.

**BLOCK II Electrical engineering**

**Unit II.1.** Introduction to Electrical Circuits

General concepts. Passive and active components. Resolution of electrical circuits. Kirchhoff's Laws, Knot and Mesh Method. Some electrical circuit theorems.

**Unit II.2**. Introduction to alternating current (AC). Single-phase systems.

Generation of alternating voltages. Transient regime and permanent regime. Representations of sinusoidal functions: Cartesian, kinetic, phasorial and complex. Operations with phasors. Complex impedance and generalized Ohm's law. Angular phase shift between voltage and current. Power in alternating current. Power factor, power factor correction. Single-phase circuit problems.

**Unit II.3.** Three-phase systems.

Three-phase electromotive force systems, advantages over single-phase systems. Wye (or star or Y) and Delta (or Δ) three-phase systems. Resolution of symmetrical or balanced three-phase circuits. Power in three-phase systems: active, instantaneous, reactive, apparent and complex. Power measurement and power factor correction in three-phase systems. Three-phase circuit problems.

**Unit II.4**. Introduction to AC Power Lines.

Production, transport and distribution of electrical energy. Classification of power lines. Introduction to the conductors' section calculation in AC power lines.

## Methodology

| Content and Activity | RA | Hours PA | Hours PL | Hours NP | Hours Tot | Evaluation |
|---|---|---|---|---|---|---|
| **BLOCK I** | | | | | | |
| Units 1 i 2 | 1 | 3 | 2 | 8 | 13 | Exercices |
| Units 3,4,5 | 3 | 11 | 1 | 20 | 32 | Exercices |
| Unit 6 | 2 | 5 | 1 | 10 | 16 | Exercices |
| Unit 7 | 3 | 3 | 1 | 7 | 11 | Exercices |
| Prova 1 Written exam | | 3 | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 25 | 5 | 45 | 75 | |
| **BLOCK II** | | | | | | |
| **Unit II.1.** Introduction to Electrical Circuits | 1 | 3 | | 5 | 8 | Exercices |
| **Unit II.2**. Introduction to alternating current (AC). Single-phase systems | 1,2 | 10 | | 16 | 26 | Exercices |
| **Unit II.3.** Three-phase systems | 3,4 | 10 | | 16 | 26 | Exercices |
| **Unit II.4**. Introduction to AC Power Lines | 1,4 | 5 | | 8 | 13 | Exercices |
| Written exam | | 2 | | | 2 | |
| | | 30 | | 45 | 75 | |
| **BLOCK III** | | | | | | |
| Unit 1 Màquines de fluid tèrmiques i turbomàquines | 1-2 | 12 | 2 | 23 | 37 | Exercices |
| Prova 1 Written exam unit 1 | 7-8 | 1 | | | 1 | |
| Unit 2 Mecanismes i disseny d'elements de màquines | 3,4,9 | 5 | 2 | 11 | 18 | Exercices |
| Unit 3 Oleohidràulica agrícola | 5,6,10 | 5 | 11 | | 16 | Exercices |
| Prova 2 Written examt Units 2 i 3 | | 1 | 2 | | 3 | |
| | | 24 | 6 | 45 | 75 | |
| Total | | 79 | 11 | 45 | 225 | |

**Observations**
Tutoring will be on-demand and face-to-face.

## Development plan

| Setmana | Setmana | H. Ggran | nº Grup | H. Prac Gpetit | H. Acum | |
|---|---|---|---|---|---|---|
| 1 | 15/02/2021 | 6 | | | | Electrical Eng. |
| 2 | 22/02/2021 | 4 | | 2 | | Electrical Eng. |
| 3 | 01/03/2021 | 6 | | 2 | | Electrical Eng. |
| 4 | 08/03/2021 | 8 | | 2 | 30 | Electrical Eng. |
| 5 | 15/03/2021 | 4 | | | 26 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | 22/03/2021 | 6 | Av Electrotec. 23/03 | 2 | | | Motors |
| 7 | 16/03/2020 | 6 | | | | | |
| 8 | 24/03/2020 | | | | | | |
| 9 | 31/03/2020 | 6 | | | | | |
| | 07/04/2020 | S Santa | | | | | |
| 10 | 14/04/2020 | 4 | | | | | |
| 11 | 21/04/2020 | 4 | Aval motors | | 28 | | |
| 11 | 23/04/2020 | 2 | | | | | Hidraulica |
| 12 | 28/04/2020 | 4 | | | | | |
| 13 | 05/05/2020 | 2 | | | | | |
| 14 | 12/05/2020 | 4 | | 2 | | | |
| 15 | 19/05/2020 | 6 | | | | | |
| 16 | 26/05/2020 | 4 | | | 28 | | |

## Evaluation

**Block II Electrotechnics (Electrical Engineering)**

The evaluation of this block will consist of the realization, by the student, of a written test.

The written test (exam) will consist of a set of questions (which may consist of problems, questions, etc.) which will assess the knowledge and skills acquired throughout the development of the block of the subject and will have to be resolved within 2 hours. The subject to be examined will include the concepts explained in the theoretical sessions and in the problem-solving sessions. If applicable, the written test can be taken using the "Tests and questionnaires" tool of the Virtual Campus.

The student can use a form in which there can only be mathematical formulas and expressions, but not words or written text, nor titles.

In addition to the written test, the student may choose, optionally, to solve, in person, up to 10 exercises/problems posed by the teacher. These exercises must be delivered solved through virtual campus, at the latest, one day before the written test. The presentation of the exercises solved in the fixed term will give right to add, to the mark of the examination, 0,1 points by each exercise presented and solved satisfactorily, until a total of 1 point at the most, in accordance with the procedure explained below. These points (up to a maximum of 1) or point fractions, will be added to the final mark of the written test (exam) according to the following rules:

a) if the mark of the exam is lower than 5, 0.1 points will be added for each exercise presented and solved satisfactorily, until reaching a maximum total mark of 5, if applicable.

b) if the mark of the exam is between 5 and 6, 0.1 points will be added for each exercise presented and solved satisfactorily, until reaching a maximum total mark of 6, if applicable.

c) if the mark of the exam is between 6 and 7, 0.1 points will be added for each exercise presented and solved satisfactorily, until reaching a maximum total mark of 7, if applicable.

d) if the mark of the exam is equal to or higher than 7, the presentation of the exercises will have no effect on the total final mark, which will be exclusively the one corresponding to the result of the exam.

## Bibliography

**Basic bibliography**

**Block I**

GILES, R.V. 2001. **Mecánica de fluidos e hidráulica**. **Problemas resueltos**. Mc Graw Hill

ARVIZA, J. 2016. **Problemas de hidraulica.** Univ. Politec. Valencia.

STREETER, V. M**ecánica de fluidos**. Mc Graw Hill

BARRAGÁN, J.; MONSERRAT, J. (2004) - **Algunas notas para Hidráulica y Riegos**- ETSEAgraria-Lleida

**Block II**

ROSELL, J.R. 2000 **"Circuitos eléctricos monofásicos y trifásicos"** Edicions de la Universitat de Lleida

**Block III**

AGÜERA, J. 1999. **"Termodinámica lógica y motores térmicos"**. 6ª edición mejorada. Madrid: Editorial Ciencia 3, S. A.

GIL, J. 1998. **"Elementos hidráulicos en los tractores y máquinas agrícolas"**. 2ª edición, revisada y ampliada. Madrid, Ediciones Mundi-Prensa, 256 pp.

**Complementary bibliography**

**Block I**

AGÜERA, J. 1996. **Mecánica de los fluidos incompressibles y turbomaquinas hidraulicas**. Ed. Ciencia 3

LAZARO LOPEZ, A. 1997. **Manual de hidràulica** . Universidad de Alicante

CABRERA, E. y d'altres (1996). **Ingeniería hidráulica aplicada a los sistemes de distribución de agua. Vol. I** Universitat Politècnica de Valencia.

CHOW, V.T. 1994. **Hidraulica de los canales abiertos.** Ed. Mc Graw Hill.

**Block II**

GARCIA, J. 2004 **"Instalaciones eléctricas en media y baja tensión"** Ed. Thomson – Paraninfo – (2004)

GARCÍA TRASANCOS, J. 2006. **Electrotecnia**. 9ª ed. Madrid: Thomson-Paraninfo.

LUNA SANCHEZ, L. *et al*. 2008. **Instalaciones eléctricas de baja tensión en el sector agrario y agroalimentario**. Madrid: Ediciones Mundi-Prensa.

**Block III**

BOTO, J.A. 2000. **"La mecanización agraria**". Universidad de León.