



Course guide

390205 - SCE - Energy Systems and Components

Last modified: 10/07/2023

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 745 - DEAB - Department of Agri-Food Engineering and Biotechnology.

Degree: BACHELOR'S DEGREE IN BIOSYSTEMS ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN FOOD ENGINEERING (Syllabus 2009). (Compulsory subject).
BACHELOR'S DEGREE IN AGRONOMIC SCIENCE ENGINEERING (Syllabus 2018). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish, English

LECTURER

Coordinating lecturer: JOAN MAJO ROCA
Salcedo Cidoncha, Ramon

Others: Jordi Llop Casamada
Salcedo Cidoncha, Ramon

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
2. Rural engineering: engines and machinery, electrical engineering.

TEACHING METHODOLOGY

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LEARNING OBJECTIVES OF THE SUBJECT

To track this course is that students achieve a basic vocabulary and an overview of energy systems. It aims to introduce students to the basics of electrical and thermal power systems, their applications, as well as saving technologies and energy efficiency, not to mention environmental issues.

Must be able to know the behavior of electrical systems, machines thermal criteria of energy efficiency and environmental protection. It aims to have the capacity to select and successfully apply these technologies in rural areas, as well as mastering the techniques of calculation introduced the subject.

STUDY LOAD

Type	Hours	Percentage
Hours small group	20,0	13.33
Hours large group	40,0	26.67
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

INTRODUCTION TO ENERGY SYSTEMS

Description:

Introduction to the subject. Macro quantities of energy. Demand for primary energy-producing and energy end. Energy intensity. Environmental impact of energy consumption.

Related activities:

Activity 1: Class of theoretical explanation

Activity 2: Individual final assessment

Activity 5: Work: Update energy data

Full-or-part-time: 5h

Theory classes: 2h

Self study : 3h

ELECTRICAL SYSTEMS single and three phase

Description:

AC single phase. Representation Cartesian and complex. Serial and parallel connection. Instantaneous power, active, reactive and apparent. Theorem Boucherot. Energy efficiency in power transmission. Improved power factor.

Three-phase systems. Connecting generators and receivers in star and triangle. Relations-voltage intensity. Active power, reactive and apparent three-phase systems. Improved power factor receptors balanced.

Related activities:

Activity 1: Class of theoretical explanation

Activity 2: Individual final assessment

Activity 3: Solving exercises and problems

Activity 4: Practice Lab. Measure three phase power systems.

Activity 5: Work: Description of electrical installation

Full-or-part-time: 45h

Theory classes: 10h

Laboratory classes: 8h

Self study : 27h

ELECTRICAL MACHINES

Description:

Basic principles of electrical machines. Classification. Qualitative study of generators and transformers. Three-phase electric motors: synchronous speed; slip; torque-speed curve; diagram powers; nameplate. Energy efficiency loads driven by electric motors. Speed regulation. Frequency inverters. Applications.

Related activities:

Activity 1: Class of theoretical explanation

Activity 2: Individual final assessment

Activity 3: Solving exercises and problems

Full-or-part-time: 20h

Theory classes: 6h

Laboratory classes: 2h

Self study : 12h

DEFINITIONS AND FUNDAMENTAL CONCEPTS OF THERMAL MACHINES

Description:

Thermodynamic principles. Ideal thermodynamic cycles: cycles of steam production work (Rankine); power cycles gases (Otto, Diesel, Sabathe). Income heat. Charts and diagrams theoretical real. Components of petroleum fuels. Technical specifications (calorific value, octane, density, additives, antiknock power, volatility, etc ...). Specifications for the use of bio fuels. Combustion: mass balance and energy balance.

Related activities:

Activity 1: Class of theoretical explanation
Activity 2: Individual final assessment
Activity 3: Solving exercises and problems

Full-or-part-time: 30h

Theory classes: 8h
Laboratory classes: 4h
Self study : 18h

POWER AND EFFICIENCY OF MOTORS endothermic

Description:

Diagrams pressures. Powers: indicated effectively absorbed half. Yields. Specific consumption. Cost of operation. Characteristic curves (power, torque). Calculating powers. Brake torque (power measurement)

Related activities:

Activity 1: Class of theoretical explanation
Activity 2: Individual final assessment
Activity 3: Solving exercises and problems
Activity 4: Practice Lab.

Full-or-part-time: 30h

Theory classes: 8h
Laboratory classes: 4h
Self study : 18h

PRODUCTION OF HEAT AND COLD AND MORE EFFICIENT TECHNOLOGIES

Description:

Steam production: boilers. Classification. Yields. Components of the facilities. More efficient technologies.

Cooling systems. Diagram of compression refrigeration cycle. Components of a cooling system. Technologies efficient cooling systems.

CHP: concept, classification, characteristic parameters (REE ratio E/V , PES, etc ...) and application examples. Trigeneration.

Related activities:

Activity 1: Class of theoretical explanation

Activity 2: Individual final assessment

Activity 3: Solving exercises and problems

Full-or-part-time: 20h

Theory classes: 6h

Laboratory classes: 2h

Self study : 12h

ACTIVITIES

ACTIVITY 1. THEORETICAL EXPLANATION

Full-or-part-time: 88h

Theory classes: 38h

Self study: 50h

ACTIVITY 2. INDIVIDUAL ASSESSMENT TESTS

Full-or-part-time: 2h

Theory classes: 2h

ACTIVITY 3. RESOLUTION OF EXERCISES AND PROBLEMS

Full-or-part-time: 40h

Laboratory classes: 16h

Self study: 24h

ACTIVITY 4. LABORATORY

Full-or-part-time: 10h

Laboratory classes: 4h

Self study: 6h

ACTIVITY 5. DESCRIPTION AND ANALYSIS OF A DOMESTIC ELECTRICAL INSTALLATION

Full-or-part-time: 10h

Self study: 10h



GRADING SYSTEM

BIBLIOGRAPHY

Basic:

- Molina Martínez, José Miguel; Cánovas Rodríguez, Francisco Javier; Ruz Vila, Francisco Asís. Motores y máquinas eléctricas: fundamentos de electrotécnica para ingenieros [on line]. Barcelona: Marcombo, 2012 [Consultation: 27/09/2023]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=9742. ISBN 9788426717948.
- Boix, O.; Sainz, L.; Córcoles, F.; Suelves, F.J. Tecnología eléctrica [on line]. Barcelona: Ceysa, 2002 [Consultation: 28/11/2023]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3226770>. ISBN 8486108233.
- Llorens, M.; Miranda, A.L. Ingeniería térmica. Barcelona: CEAC, 1999. ISBN 843296560X.
- Giacosa, D. Motori endotermici. 14a. Itàlia: Hoepli Editore, 1986. ISBN 8820314576.
- Agüera Soriano, José. Termodinámica lógica y motores térmicos. 6ª ed. mejorada. Madrid: Ciencia 3, 1999. ISBN 8486204984.

Complementary:

- Mitjà, Albert. La Cogeneració en els anys noranta : experiències a Catalunya. Barcelona: Generalitat de Catalunya. Departament d'Indústria i Energia, 1994. ISBN 8439329237.
- Hoz Casas, Jordi de la; Blas del Hoyo, Alfredo de. Máquinas eléctricas [on line]. Barcelona: Edicions UPC, 2006 [Consultation: 15/04/2020]. Available on: <http://hdl.handle.net/2099.3/36709>. ISBN 9788483018705.
- De Francisco, A.; Castillo, J.L.; Torres, J.L. La Energía eléctrica en la explotación agraria y forestal. Madrid: Mundi Prensa, 1993. ISBN 847114333X.
- Cedrà, C. Les tracteurs agricoles. París: Tec & Doc, 1991. ISBN 2852068095.

RESOURCES

Hyperlink:

- Programes informàtics PROPAGUA i PROGASES. <http://www.tecnun.es/asignaturas/termo/SOFTWARE/SoftTD.htm>