Universidad de Alcalá

TEACHING GUIDE

Power Plants

Degree in
Industrial Electronics and Automatics Engineering

Universidad de Alcalá

Academic Year 2023/2024

4th Year - 1st Semester

Approved by the School Board on June 12th, 2023

TEACHING GUIDE

Course Name:	**Power Plants**
Code:	**600036**
Degree in:	**Industrial Electronics and Automatics Engineering**
Department and area:	**Teoría de la Señal y Comunicaciones** **Electrical Engineering**
Type:	**Optional (Generic)**
ECTS Credits:	**6.0**
Year and semester:	**4th Year, 1st Semester**
Teachers:	Carlos Santos Pérez
Tutoring schedule:	Tutorial timetable is given the first day of the course
Language:	English

1. COURSE SUMMARY

Power Plants is an optional SUBJECT, related with some disciplines already studied in the Electronics and Industrial Automation Engineering Degree. It is located in the fourth year, first semester.

It develops basic knowledge on steam and gas cycles and heat exchangers, studied in Thermal Engineering, for their technical application to Power Plants. It combines also electrical machines (generators and transformers) and Fluid Mechanics (hydroelectric plants) fundamentals. Power plant control issues are also introduced. The subject is completed with the analysis of energy resources, up-to-date regulation, economic analysis and main environmental impacts of power plants.

It is subject with a high level of applicability, joining theoretical knowledge to real technology.

Prerequisites y Recommendations

Previous knowledge on Thermal Engineering (Cycles steam and gas cycles, heat exchangers), Electrical Machines (alternators and transformers) and Fluid Mechanics, taught in 2nd and 3rd course are recommended.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/351/2009:

Professional Skills

This course contributes to acquire the following professional skills, which are defined in the Section 5 of the Annex to the Orden CIN/351/2009:

Learning Outcomes

- **RACE1**: Describe and analyze current energy problems, energy resources and demand coverage.
- **RACE2**: Explain the main characteristics of thermoelectric generation technologies and analyze their operation.
- **RACE3**: Explain the main characteristics of hydroelectric generation technologies and analyze their operation.
- **RACE4**: Describe the operation of automation and control systems used in power plants.
- **RACE5**: Describe the electrical equipment used in power plants and substations.
- **RACE6**: Explain, assess and analyze the economic aspects and environmental impacts of power plants.

3. CONTENTS

Topics	ECTS
Topic 1: Introduction to energy: energy resources and electricity production, demand coverage, regulations and the electricity market	1 ECTS
Topic 2: Thermoelectric power plants: coal-fired power plants, combined cycle power plants, nuclear power plants, other technologies.	2,5 ECTS
Topic 3: Conventional and reversible hydroelectric plants	1 ECTS
Topic 4: Regulation and control of power plants and their connection to the grid.	0,75 ECTS
Topic 5: Economic study and environmental impact of power plants	0,75 ECTS

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58 hours (56 hours on-site +2 exams hours)
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

Theoretical sessions	Methodology: expository sessions where the teacher presents and explains the theoretical aspects of the subject, complemented by basic practical applications and real examples. The participation of the students in the own development of the contents of the subject will be encouraged after the autonomous and group bibliographic search. Available resources: blackboard, audiovisual media, internet access, bibliography. Number of students per class: 50 students
Practical sessions	Methodology: group and individual workshops. Discussion in small groups of the approach of the projects, practical cases and their relation with theory. Written and oral presentation of resolution alternatives. Sharing of proposals and results. Available resources: blackboard, audiovisual media, bibliography. Number of students per class: 25 students
Tutorials and seminars	Individual and / or group tutorials on the theoretical and practical contents of the subject. Support for autonomous learning.
Off-class activities	Problem solving by application of the theory, bibliographic search, development of group work

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

Ordinary Call

Continous Assessment:

The main assessment tools will be:

1. Problems (EP). Solving practical problems individually or in small groups. Solving practical problems individually or in small groups.
2. Laboratory Exercises (EL). Performance of laboratory practices and delivery of the corresponding reports. The evaluation will consider systematic observation, where the teacher will record the main difficulties and skills observed in each student, and the realization of a single memory by practice, by each of the groups of students who have done it.

3. **Assessment** Tests (PE). Performing written tests focused on both practical and theoretical aspects of the subject.

Students must attend 100% of the laboratory sessions and deliver the corresponding reports to all laboratory practices. Recovery sessions will be enabled for those students who have not attended any of the sessions and justify it documentarily.

The students, as a group, will deliver the reports of the laboratory practices following the established schedule. These practices will be evaluated by the professor responsible for the laboratory group, to assess if the objectives indicated in the script of the same have been met.

Assessment through final exam:

In the case of evaluation by means of a final exam, the evaluation elements to be used will be the following:

Extraordinary Call

The procedure will be the same as that described for the assessment by means of a final exam in the ordinary call.

5.2. EVALUATION

By default, students will follow a system of continuous assessment with characteristics of formative evaluation, so that it serves the student as feedback in the teaching-learning process. To this objective, the following evaluation procedures are established:

Aseessment procedures

Ordinary Call: The evaluation in the ordinary call must be inspired by the criteria of continuous evaluation (Normativa de Regulación de los Procesos de Enseñanza Aprendizaje, NRPEA, art 3).

Continuous Evaluation: It will consist in the realization and presentation, individually or in groups, of practical problems and theoretical approach tasks, and the completion of a written final exam.

Final Evaluation: it will consists in the completion of a written final exam.

Extraordinary Call: It will consist of a written final exam.

In order to benefit from the final evaluation process, the student must apply (written form) the Center Director in the first two weeks of his / her incorporation, indicating the reasons that prevent him / her from following the continuous evaluation system. The Director will communicate the resolution in a maximum of 15 days. In case of not having received a response, this request is considered positive.

Assessment Criteria

The evaluation of the student will be based on the following criteria:

CE1: The student understands the basic concepts that characterize the current electric sector and its electric generation technologies.

CE2: The student knows and is able to analyze the technical specifications of the electric generation technologies dealt with in this course.

CE3: The student applies its knowledge to the resolution of practical cases.

CE4: The student has the ability to selectively search for bibliographic information and to use this information.

CE5: The student analyzes, discusses, synthesizes and presents the results obtained in an appropriate way.

Assessment instruments.

This section specifies the assessment instruments that will be applied to each of the evaluation criteria.

1. Deliverables (E): Consists of the realization and delivery, individually or in groups, of practical problems and theoretical approach tasks associated with the different topics of the course.
2. Final Exam (PEF) Test: Consists of a written test on the analysis and resolution of practical and theoretical issues, integrating the whole course.

Grading Criteria

This section quantifies the grading criteria for passing the course:

Ordinary Call. Continuous assessment

In the ordinary call-continuous assessment, the relationship between the criteria and assessment instruments and the weight in the final mark is specified:

Learning results	Assessment criteria	Assessment instruments	Final mark weight
RACE1-RACE6	CE1-CE5	E1-E5	60%
RACE1-RACE6	CE1, CE2, CE3, CE5	PEF	40%

None of the deliverable assessment instruments E will weigh more than 30% of the final mark.

As a general criterion, students in ordinary call who do not attend the final written test will be considered as Not presented.

Ordinary Call. Final Evaluation

Learning results	Assessment criteria	Assessment instruments	Final mark weight
RACE1-RACE6	CE1, CE2, CE3, CE5	PEF	100%

Extraordinay Call

Learning results	Assessment criteria	Assessment instruments	Final mark weight
RACE1-RACE6	CE1, CE2, CE3, CE5	PEF	100%

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Moran M, Shapiro H, “Fundamentals of Engineering Thermodynamics”, John Wiley &Sons, 2008.
- Sakar, Dipak, “Thermal Power Plant”, Elsevier, 2015.
- Boyce, M.P. “Handbook for Cogeneration and Combined Cycle Power Plants”, Asme Press, Second Edition, 2010
- Black & Veatch. Power plant engineering. Edita: Kluwer Academic Publishers. 2011.
- International Energy Agency, https://www.iea.org/
- Online material (Blackboard)

6.2. Additional Bibliography

Disclosure Note

During the evaluation tests, the guidelines set out in the Regulations establishing the Rules of Coexistence of the University of Alcalá must be followed, as well as the possible implications of the irregularities committed during said tests, including the consequences for committing academic fraud according to the Regulation of Disciplinary Regime of the Students of the University of Alcalá.