Course guides
820326 - TECE - Power Station Technology

Last modified: 30/06/2021

Unit in charge: Barcelona East School of Engineering
Teaching unit: 748 - FIS - Department of Physics.

Degree: BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2021 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: YOURI ALEXANDROVICH KOUBYCHINE MERKULOV

Others: Primer quadrimestre:
GUILLEM PERE CORTES ROSSELL - T11
YOURI ALEXANDROVICH KOUBYCHINE MERKULOV - T11

Segon quadrimestre:
YOURI ALEXANDROVICH KOUBYCHINE MERKULOV - M11, M12
VÍCTOR MANUEL MARTÍNEZ QUIROGA - M11, M12

PRIOR SKILLS

Those given by the following courses:
- Mechanics of Fluids
- Thermodynamics and Heat Transfer
- Energy Resources
- Thermal and Fluid Dynamic Power Generation

REQUIREMENTS

GENERACIÓ TERMOFLUIDODINÀMICA - Prerequisit

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEENE-15. Analyse energy transformation mechanisms inside machines.

CEENE-200. Measure and design energy production systems based on nuclear power.

Transversal:
05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.

TEACHING METHODOLOGY

The subject is based on sessions face-to-face in the classroom or via videoconference (lectures and practices) and non-contact student work, with individual activities and activities to do in cooperative team. Interactive sessions and presentations of exercise solutions by students are also envisaged.
During lecture sessions the professor will explain theoretical concepts, used technologies and techniques to characterize processes and facilities of the power plants.
In the practical sessions the students will work in small groups under the teacher supervision on solution of exercises devoted to calculation of characteristics of processes and facilities of the power plants. Delivery of work reports will contribute to the course evaluation with a certain weight.
A continuous evaluation is the option recommended for a better and effective course follow-up. This evaluation, besides the middle-term and final tests or exams done individually, includes also course activities carried out in the classroom or out of it individually or in work groups.
A student who chooses this modality of evaluation will have to satisfy the following requirements:
1) form part of one of the base groups,
2) having participated in at least 75% of the course activities carried out in the class,
3) having carried out at least 60% of the work result deliveries.

The course activities include solution of short exercises or completion of mini-studies on some topics proposed by the professor. These activities aim to evaluate both the theoretical knowledge and practical skills of the students and their general aptitudes like synthesis, reasoning, deduction, etc.
Individual activities out of the class include solution of various exercises to prepare in advance the practical sessions or to settle the concepts of the lectures. Carrying out these activities will have a contribution on the assessment of the course with a certain weight.
Evaluation tests will be carried out to ensure that the students have carried out the activities and have assimilated the concepts. In some cases of group activities mechanisms to establish the individual grade of each group member will be implemented.
The ATENEA digital platform will be used to provide course materials and activities descriptions, as well as a space for deliveries of student reports.

LEARNING OBJECTIVES OF THE SUBJECT

The course teaches the students methods, both established nowadays and those in development, used at power plants for the electricity generation that allow to take advantage of various energy sources and understand physical and technological principles of transformation and use of thermal and fluidodynamic energy.

Also, the course makes the student to be aware of socioeconomic and environmental implications of the energy transformation and energy use.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Hours large group	45,0	30.00
Self study	90,0	60.00

Total learning time: 150 h

CONTENTS

Introduction

Description:
Overview of the subject and organization of the course.
Energy systems. Reserves and resources, today situation of the main fuels.
Concept of primary energy, secondary energy, final and useful energies and relations between them.
Analysis of flow diagrams and energy balances.
Relation between energy consumption of a country and its economical activity (energy intensity etc.)

Full-or-part-time: 1h 30m
Theory classes: 1h 30m

Combined cycle power plants

Description:
Description of the technology of thermal power plants with steam cycle and gas cycle. The focus is on gas turbines and recovery boilers.

Related activities:
There will be practical sessions where the main parameters involved in the energy balance in this type of plants will be calculated. In addition, a series of non-contact activities will be programmed to be solved individually or in team.

Full-or-part-time: 23h 30m
Theory classes: 4h 30m
Laboratory classes: 4h
Self study : 15h

Nuclear power plants

Description:
Exposition of the fundamentals underlaying the use of this type of energy. Description of the main technologies.

Related activities:
There will be practical sessions where the main parameters involved in the energy balance in this type of plants will be calculated and about the nuclear fuel cycle. In addition, a series of non-contact activities will be programmed to be solved individually or in team.

Full-or-part-time: 30h
Theory classes: 6h
Laboratory classes: 4h
Self study : 20h

Hydropower

Description:
Description of the resource, siting and technologies. Overview of a plant and its components. Introduction to pumped-storage plants.

Related activities:
There will be practical sessions where the main parameters involved in the energy balance of hydroelectric power plants will be calculated, with a focus on the energy accumulation capabilities of some plants. In addition, a series of non-contact activities will be programmed to be solved individually or in team.

Full-or-part-time: 21h 30m
Theory classes: 4h 30m
Laboratory classes: 2h
Self study : 15h

Cogeneration and trigeneration

Description:
Analysis of advantages and disadvantages of cogeneration and trigeneration. Description of the technologies. Balance calculations and determination of the efficiency parameters.

Related activities:
There will be practical sessions where the main parameters involved in the energy balance in this type of plants will be calculated. In addition, a series of non-contact activities will be programmed to be solved individually or in team.

Full-or-part-time: 21h 30m
Theory classes: 4h 30m
Laboratory classes: 2h
Self study : 15h

Closing sessions

Description:
Sessions to summarize all studied technologies and its combined use. A part of the sessions will include presentations of results of studies performed by the students individually or in groups.

Related activities:
A series of non-contact activities will be programmed to be solved individually or in team.

Full-or-part-time: 6h 30m
Theory classes: 1h 30m
Self study : 5h

GRADING SYSTEM

During the term the students will do two exams, of duration between 100 minutes and 150 minutes each. The midterm exam will be on concrete topics of the course, and the final one will be synthetic, besides including the last course topics. Each exam will include a theoretical part and a part on problems solutions.
The grading of a student will be based on the following evaluations:
- Grade of the course activities (AC).
- Midterm exam (EP)
- Course final exam (EF)
- Practice works (TP).

The final grade NF is calculated as the maximum of the following two options:
NF1=0,2 EP + 0,4 EF + 0,2 TP + 0,2 AC, with condition EF ≥4
NF2=0,8 EF + 0,2 TP
NF = max(NF1,NF2)
This course includes an option of a reevaluation exam. In order to be able to access to this option a student must comply with the requirements stipulated in Normativa d'Avaluació i Permanència of the EEBE (https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf)
In the case of reevaluation exam the final grade NF = 0,8 Reevaluation grade + 0,2 TP

EXAMINATION RULES.

- Is not allowed to do theory exams with any book or class notes but is allowed a scientific calculator not programable
- Is allowed to do problem exams with class notes and additional bibliography and also a scientific calculator not programable
- The detection of and irregular action during the evaluation that could change the mark significantly could imply fail the overall subject.

BIBLIOGRAPHY

Complementary:
- Lamarsh, John R; Baratta, Anthony J. Introduction to nuclear engineering. 3rd ed. Essex: Pearson, cop. 2014. ISBN 9781292025810.
- Palacín, Pere; Oriol, Josep. Tecnología energética. PPU, 2013. ISBN 9788494161827.
- Fernández Díez, Pedro. Libros sobre ingeniería energética [on line]. Pedro Fernández Díez, 2000-20 [Consultation: 15/07/2020]. Available on: http://es.pfernandezdiez.es/.
- Moran, Michael J.; Shapiro, Howard N. Fundamentos de termodinámica técnica. 2ª ed. Barcelona: Reverté, cop. 2004. ISBN 8429143130.

RESOURCES

Other resources:
The course is too wide to have abasic bibliography. The course materials in Atenea should be sufficient for the follow-up of the course. However, some complementary bibliography is provided.