



COMILLAS

UNIVERSIDAD PONTIFICIA

ICAI

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CIHS

Syllabus
2023 - 2024

GENERAL INFORMATION

Data of the subject	
Subject name	Energy Engineering
Subject code	DIM-MII-522
Main program	Official Master's Degree in Industrial Engineering
Involved programs	Máster Universitario en Ingeniería Industrial [First year]
Level	Postgrado Oficial Master
Quarter	Semestral
Credits	7,5 ECTS
Type	Obligatoria
Department	Department of Mechanical Engineering

Teacher Information	
Teacher	
Name	José Ignacio Linares Hurtado
Department	Department of Mechanical Engineering
Office	Alberto Aguilera 25 [D-315]
E-Mail	linares@icai.comillas.edu
Phone	2368
Teacher	
Name	Beatriz Yolanda Moratilla Soria
Department	Department of Mechanical Engineering
Office	Alberto Aguilera 25 [D-306]
E-Mail	ymoratilla@icai.comillas.edu
Phone	2363
Teacher	
Name	Bienvenido Martínez Pantoja
Department	Department of Mechanical Engineering
E-Mail	bmartinez@icai.comillas.edu
Teacher	
Name	Federico Ramírez Santa-Pau
Department	Department of Mechanical Engineering
E-Mail	framirez@icai.comillas.edu
Teacher	
Name	Francisco González Hierro



Department	Department of Mechanical Engineering
E-Mail	fgonzalez@icai.comillas.edu
Teacher	
Name	Iñigo Sanz Fernández
Department	Department of Mechanical Engineering
E-Mail	isanz@icai.comillas.edu
Teacher	
Name	José Rafael Rubio Caldera
Department	Department of Mechanical Engineering
E-Mail	jrrubio@icai.comillas.edu
Teacher	
Name	José Rubén Pérez Domínguez
Department	Department of Mechanical Engineering
E-Mail	jrpdominguez@icai.comillas.edu
Teacher	
Name	Leopoldo Prieto Fernández
Department	Department of Mechanical Engineering
E-Mail	lpfernandez@icai.comillas.edu
Teacher	
Name	Luis López Álvarez
Department	Department of Mechanical Engineering
E-Mail	llopez@icai.comillas.edu
Teacher	
Name	Luis Yagüe Muñoz
Department	Department of Electrical Engineering
E-Mail	lyague@icai.comillas.edu

DESCRIPTION OF THE SUBJECT

Contextualization of the subject

Prerequisites

There are not any prerequisites needed to study the subject. However, as the subject is inserted in an engineering syllabus, it is supported on concepts previously seen in other subjects:

Thermodynamics

- Energy and mass balances



Heat transfer

Heat exchangers

Course contents

Contents

Theme 1: Systems

Unit 1: Introduction

1. Energy, classifications and types. Energy sources.
2. Macro-energy units.
3. Environmental implications of power generation.
4. Social and geostrategical aspects of energy sources.
5. Assessment of scenarios and energy policies.
6. Assessment of economic feasibility of energy projects.

Unit 8: Analysis of energy systems in off-design working

1. Introduction.
2. Heat exchangers and ducts.
3. Volumetric machines.
4. Turbomachines.
5. Systems integration.

Theme 2: Energy sources

Unit 2: Combustion

1. Introduction.
2. Combustion reactions.
3. Mass balance.
4. Energy balance.

Unit 6: Nuclear energy

1. Introduction
2. Nuclear reactions.
3. Systems and components of a nuclear reactor.
4. Nuclear fuel cycle.
5. Nuclear wastes.
6. Ionizing radiations.
7. Nuclear fusion.
8. Nuclear power plants: types and Generations
9. Current nuclear power plants: Generation II and III
10. Forthcoming nuclear power plants: Generation III+, IV and fusion

Unit 7: Fossil fuels



1. Introduction
2. Oil and derivatives production and distribution.
3. Natural gas production and distribution.
4. Coal production and distribution.
5. Non-conventional hydrocarbons production.
6. CO2 storage.

Theme 3: Energy conversion

Unit 3: Fossil fuel power plants

1. Introduction.
2. Coal power plants (steam cycle).
3. Combined cycle power plants.
4. Repowering of coal power plants.
5. Clean combustion in power plants.
6. CO2 capture.

Unit 4: Refrigeration cycles and heat pumps

1. Introduction.
2. Low temperature chillers.
3. Advanced heat pumps.
4. Non-conventional chillers.
5. Absorption chillers.

Unit 5: Advanced power plants

1. Introduction.
2. Combined heat and power.
3. Organic Rankine cycles.
4. Supercritical CO2 cycles.
5. Other power plants.
6. Electric generation from renewable sources
7. Massive energy storage.

EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
Exams Problems or case study	Both the procedure chosen for the resolution of the problem as well as the numerical results, which, although they may be incorrect, must be coherent and logical.	35



Exams Qualitative questions	Various concepts presented in the subject will be developed or a critical judgement on a technological solution to a problem will be issued based on the concepts seen in the course.	25
Exams Tests questions	The right answer should be identified within a set of options.	10
Continuous assessment Laboratory sessions	Attendance is mandatory. The report delivered after session will be scored.	15
Continuous assessment Team works	Works will be developed in groups based on teacher proposal. A report will be written, which will be presented in the classroom.	15

Grading

Ordinary summon

The score for the **ordinary summon** will be obtained by:

- 70% comes from the exams. End of term exam score will weight 50% in the overall score of the subject while the score in the mid term exam will weight 20%.
- 15% comes from team work.
- 15% comes from the lab sessions reports.

If the previous weighted average results higher than 5 the subject score will be such average; in the opposite case the score will be the minimum between such average and the end of term exam score.

Final score might be increased up to 0.5 points depending on student participation on the subject Forum. Quantity and quality of the participation will be taken into account. The lack of participation in such Forum will never penalize the score of the subject.

Extraordinary summon

The score for the **extraordinary summon** will be obtained by:

- 20% from the score obtained in continuous evaluation (average between team work and lab reports).
- 80% from the extraordinary summon exam.

If the previous weighted average results higher than 5 the subject score will be such average; in the opposite case the score will be the minimum between such average and the extraordinary summon exam score.

Final score might be increased up to 0.5 points depending on student participation on the subject Forum. Quantity and quality of the participation will be taken into account. The lack of participation in such Forum will never penalize the score of the subject.

Rules



Attendance (see latter) and work team and lab reports performing is a necessary condition to pass the subject in both summons.

Neither programmable calculators nor formulae summary, books and notes are allowed. In the exams a formulae summary covering economic parameters (unit 1) and cogeneration indexes (unit 6, if applicable) will be included. A sample of such summary can be found in past exams available in Moodle.

Attendance: The absence of more than 15% of the total amount of classes can entail to fail the ordinary summon.

WORK PLAN AND SCHEDULE

Activities	Date of realization	Delivery date
Self-learning of concepts presented in class (slides and additional text if any)	After session	
Problem solving	After the end of the unit	
Mid term and end of term exam	Week 8 and ordinary summon period	
Mid term exam preparation	At least weeks 7 and 8	
End of term exam preparation	At least weeks 13, 14 and 15	
Lab sessions	Weeks 11, 12, 13 and 14	
Lab sessions reports performing		Weeks 12, 13, 14 and 15
Teams work performing	Weeks 3 to 15	M1: week 7; M2: week 11; M3: week 13 to 15
Teams work presentation	Weeks 13 to 15	

BIBLIOGRAPHY AND RESOURCES

Basic References

- Slides of every unit (available at Moodle).
- Additional texts of nearly all the units (available at Moodle).
- Solved problems (available at Moodle).
- Solved exams (available at Moodle).

Additional references

- E. Cassidy and P. Grossman, Introduction to Energy: Resources, Technology and Society. Cambridge University Press, 1998

- R.W. Haywood, Analysis of Engineering Cycles, 4th Edition. Pergamon Press, 1991.

In compliance with current regulations on the **protection of personal data**, we would like to inform you that you may consult the aspects related to privacy and data that you have accepted on your registration form by entering this website and clicking on "download"

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