ISEL
INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

ISEL ADEM
Área Departamental de Engenharia Mecânica

Sheet course ()

Course	MSc IN MECHANICAL ENGINEERING		
Unit	Production and Management of Energy	Mandatory	☒
		Optional	☐
Unit scientific area	Thermofluids and Energy	Category	E

Unit category: B - Basic; C - Core Engineering; E - Specialization; P - Complementary.

Year: 1st	Semester: 2nd		ECTS:			
Contact time	Total: 68	T: 40	TP: 28	PL:	S:	OT:

T - Lectures; TP - Theory and practice; PL - Lab Work; S - Seminar; OT - Tutorial Guidance.

Unit Director	Title	Position
Paulo de Santamaria de S. T. Gouveia	Charter Engineer	Assistant Professor

Learning Objectives (knowledge, skills and competences to be developed by students)

(max. 1000 characters)

Provide the mechanical diplom engineer the means to understand and model the energy flows in industrial systems and buildings or other complex equipments. Define actions to rationalize the use of energy, quantifying the economical and environmental benefits arising from that.

Sustainable development versus production and energy management . Production and energy management and its rational use. Process integration/transformation of energy resources. Existing technologies and future developments.

Scenarios for specific Sectors integrated in the context of the EU directives. Targets, measures and current situation. Research and analysis of national and international documentation: Energy Agencies , Government Programs , etc.

Theoretical and practical aspects related to Energy Management. Scenario analysis: national , EU and global . Technologies and applications.

The energy sector and environmental policy. Government strategy for economic development.

Syllabus

(max. 1000 characters)

FUNDAMENTAL CONCEPTS

Different types of energy. Primary Energy: Production and Consumption. Energy Conversion. Energy indicators. Sustainable Development. Energy and Environment. Politics and Economics. Presentation and

analysis of scenarios: National , EU and worldwide . Transport Sector.

ENVIRONMENT

Fossil fuels and climate change . Greenhouse . The IPCC . The Kyoto Protocol .

ENERGY PRODUCTION

Fossil fuels-fired plants. Hydroelectric power stations (Hydro and Mini - Hydro). Nuclear Power. Combined cycles . Cogeneration and Trigeneration . Practical Examples .

ENERGY MANAGEMENT

Rational Use of Energy. Energy Audits, Human Resources, Technical Resources; Examination Facility; Planning Work; Data Collection, Testing and Measurement, Analysis and Data Treatment; Reports; Rationalisation Plans and Energy Consumption; Control pratices. Practical Examples.

EXAMPLES OF REAL FACILITIES AND CALCULUS

If possible regarding the Object of study visits .

Demonstration of consistency of the syllabus with the objectives of the course

(max. 1000 characters)

Very comprehensive discipline within the Energy very general broad area, that does not neglect further deepening of the various topics it addresses. The syllabus intend to meet the objectives envisaged:

i. development of the knowledge on applied thermodynamics in resolving pratical situations.

ii. detailed analysis of the energy production Theme, with the focus on physical phenomena involved.

iii. sophisticated treatment in detail of the phenomena of Energy Conversion.

iv. Integration of knowledge within Mechanical Eng., linking diferent matters to promote problem solving.

The work load designed as part of the Evaluation is targeted to achieve through the Course the application of the methodologies introduced to practical application cases (individual work), and to develop further theoretical knowledge over Themes strategically selected (Team-work).

Teaching methodology (evaluation included)

(max. 1000 characters)

Active learning, with cooperative and collaborative initiative from students, to promote interaction and class

participation.

Promotion of an integrated study method, combining the traditional component of classroom teaching with learning online, without neglecting the illustrative practical applications.

Evaluation / Grading:

Individual Applied work - Energy Auditing (30%) - with final report.

Theoretical Group Work - Development of a chapter of the Course (30%): Report, Presentation on "Power-Point" and final Oral exam.

Final Written Exam over the applied part of the Course (40%): applied Energy evaluation methods introduced during the Course.

Final Rating: The weighted average of the partial grades shall be equal or greater than 9.5 (in 20.0)

Important: The partial grades must be equal or above 7.5 (20.0 in) for any of them.

Demonstration of consistency of teaching methods with the learning objectives of the course

(max. 3000 characters)

The teaching methodology and assessment used in the Course are appropriate to achieve the objectives pursued:

• The theoretical and practical classes are being taught in the classroom, using up when possible laboratory demonstrations or actual pratical applications (study visits) .

• The content of the lessons is essentially theoretical, foreseeing lessons more practical (problems, calculations,design) to consolidate the knowledge to be acquired.

• After introducing the basic concepts, practical classes promote the structuring of thinking for applying theoretical knowledge in achieving practical solutions.

• The theoretical Team-work enables students to work in groups (even multi-teams) in developing complex models of Energy conversion/management: problem analysis, collecting the required data, search parameters and other information, organizing the calculus sequence, decisions over the characterization algorithms, analysis of results, development of final conclusions, suggestions for future improvements, etc. .

• The individual work, is a survey of energy consumption of a defined system, processing and evaluating all relevant data, which should be concluded by the implementation of the required improvements, and measuring the impact resulting from those changes.

• The Final written exam is an individual assessment of the fundamental knowledge acquired by students to ascertain that they gained more than the minimum to succeed in the course.

Main Bibliography

(max. 1000 characters)

Handouts prepared by Professor in charge of the Course.

The Computational Structure of Life Cycle Assessment, Heijungs, R., Suh, S., 2002, Springer, Dordrecht, The Netherlands

Handbook of Industrial Energy Analysis, Boustead, I. and Hancock, G., 1979, Ellis Horwood Limited, John Wiley & Sons.

Program E4 - Energy Efficiency and Endogenous Energies, Ministry of Economy, December 2001.

RGCE - Regulations on the Management of Energy Consumption.

Rgest-Regulation of Energy Consumption Management for the Transport Sector.

National Plan for Climate Change - various reports.

Programme of Action for Reducing the dependency of Portugal against the Petroleum (2004).

A European Strategy for Sustainable Energy, Competitive and Secure - Green Paper, EU, 2006.

Annual Energy Outlook, International Energy Agency

Several publications DGGE.

Several publications IEA.

Several OECD publications.

Several publications of the European Union.