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Instituto Superior de Agronomia
Universidade Técnica de Lisboa

Course Name: Environment and Energy

Responsible for the Course:
Professor Elizabeth Almeida Duarte (DQAA)
Professor Olívio Patrício (DER)

Other Teachers:

Professor Francisco Avillez (DEASR)
Professor João Santos Pereira (DEF)

Pre-requisites: General Chemistry, Biochemistry and Physics

Degree: Environmental Engineering / 5th Semester

Weekly timetable estimated and type of classes: Theoretical – 2 hours; Theoretical-Practical – 2 x 1,5 hours; Seminar – 1 hour

Programme	Duration	Teachers
1. Integration of renewal energies towards the environmental impact minimization in domestic, agriculture and industrial activities.	1st week	*Elizabeth de Almeida Duarte (DQAA)*
2. Renewable energies 2.1 Solar Photovoltaic 2.2 Solar thermo-active 2.3 Passive solar - building 2.4 Biofuels 2.4.1 Vegetable oils and its derivates 2.4.2 Alcohols and its derivates 2.4.3 Biogas production from domestics wastewater treatment sludge, urban organic waste, agriculture and animal production waste, landfields. Integrated solutions 2.4.4 Hydrogen 2.5 Eolic 2.6 Geothermic 2.7 Waves 2.8 Hydric 2.9 Hydrogen fuel cells	2nd and 3rd weeks	*Elizabeth de Almeida Duarte (DQAA)* *Olívio Patrício (DER)*
3. Fundamentals of Thermodynamics applied to the production/conversion of energy. 3.1. Basic Concepts of Thermodynamics - An Engineering Approach. 3.2 Gas Power Cycles. 3.2.1. Basic Considerations in the Analysis of Power Cycles. 3.2.2. The Carnot Cycle and its Value in Engineering. 3.2.3. Air–Standard Assumptions. 3.2.4. A Brief Overview of Reciprocating Engines. 3.2.5. Otto and Diesel Cycles.	4th to 7th weeks	*Elizabeth de Almeida Duarte (DQAA)* *Olívio Patrício (DER)*

3.2.6. Stirling and Ericsson Cycles. 3.2.7. Brayton Cycle – The Ideal Cycle for Gas – Turbine Engines. 3.2.8. The Brayton – Cycle with Regeneration. 3.2.9 The Brayton – Cycle with Intercooling, Reheating, and Regeneration. 3.3. Vapour and Combined Power Cycles. 3.3.1 The Carnot Vapour Cycle. 3.2.3. Rankine Cycle, 3.2.4. The Ideal Reheat Cycle. 3.2.5. The Ideal Regenerative Cycle. 3.2.6. Cogeneration. 3.2.7. Binary Vapour Cycles. 3.4. Refrigeration Cycles. 3.5 Cooling cycles		
4. Technologies for the production/conversion of primary energies 4.1 Combustion 4.2 Gasification 4.3 Pyrolyse 4.4 Biochemistry	8th and 9th weeks	*Elizabeth de Almeida Duarte (DQAA)* *Olívio Patrício (DER)*
5. Technologies for the production/conversion of secondary energies 5.1 Vapour engines; vapour turbines, Stirling engine 5.2 Internal combustion engines, micro turbines, gas turbines; fuel cells.	10th to 12th weeks	*Olívio Patrício (DER)*
6. Balance of energy production vs consumption: energy production environmental impacts Environmental economical costs and benefits.	13th and 14th weeks	*Francisco Avillez (DEASR)* *João Santos Pereira (DEF)*
Practical lessons	14	