

Code: 1588 Combustion**Degree:** 2nd cycle – Bioenergy Systems Engineering**Curricular Year:** 1st**Semester Course:** 2nd**Credits:** 6 ECTS**Compulsory****Language:** Portuguese/English**Responsible:** José Miguel Mendes Lopes (IST/UTL)**Other lecturer(s):** -**Web Site:** <http://www.isa.utl.pt/home/node/3923>**1. Contact hours:****Lectures 30 Practicals/Laboratory 40 Others 14 Total 84****2. Objectives:**

Teach the basic concepts of thermochemistry and chemical kinetics required to understand combustion phenomena. Apply mass and energy balances to combustion problems. Describe the main fuels and their properties. Describe the principles of flame ignition, stabilization and extinction, premixed and nonpremixed flame structure, in laminar or turbulent flow conditions. Formulate simple models to describe liquid and solid fuels combustion. Identify the main pollutants, mechanisms of formation and methods of reduction of emissions.

3. Programme:

Relevance of combustion. Combustion science and technology. Thermochemistry. Enthalpies of formation and combustion. Heating values. Adiabatic flame temperature. Chemical equilibrium. Equilibrium constants. Degree of reaction. Dissociation. Chemical kinetics. Global and elementary reactions. Reaction order. Collision frequency. Activation energy. Arrhenius equation. Reaction rates. Reaction mechanisms. Conservation equations in reacting systems: conservation equations for mass, momentum, energy and chemical species. Mixture fraction. Gaseous, liquid and solid fuels. Laminar premixed flames. Flame structure and propagation. Flame speed and flame width. Flammability limits, quenching, flashback and lift-off. Ignition. Flame stabilization. Laminar diffusion flames. Turbulent premixed and nonpremixed flames. Perfectly stirred reactor. Liquid fuels combustion. Evaporation and combustion of a spherical droplet. Sprays combustion. Solid fuels combustion. Combustion of a coal particle. Mechanisms of pollutant formation. Methods of reduction of emissions.

4. Bibliography:**Main Bibliography**

- * Combustão , Coelho, P. e Costa, M. , 2007, Ed. Orion
- * Combustion , Glassman, I., 1996, Academic Press, 3^a Edição
- * An Introduction to Combustion ? Concepts and Applications , Turns, S.R., 2000, McGraw-Hill, 2^a Edição

Other Bibliography

- * Combustion Aerodynamics , Beér, J.M. e Chigier, N.A., 1972, Applied Science Publishers Limited
- * Combustion. A Study in Theory, Fact and Application , Chomiak, J., 1990, Gordon and Breach Science Publishers
- * Applied Combustion , Keating, E.L., 1993, Marcel Dekker
- * Principles of Combustion , Kuo, K.K., 1996, John Wiley & Sons
- * Combustion Physics , Law, C.K., 2006, Cambridge University Press
- * Combustion and Mass Transfer , Spalding, D.B., 1979, Pergamon Press
- * Técnicas Instrumentais para a Análise de Escoamentos com Combustão , Heitor, M.V., 1991, Associação dos Estudantes do Instituto Superior Técnico, Secção de Folhas

5. Assessment:

Written exam (80%) and laboratorial work (20%)

6. Estimated Workload:

168	Hours
-----	-------

7. Last Update:

21/7/2010
