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| COURSE: Chemical Plants for the Energy Industry | | | |
| ACADEMIC YEAR: 2017/18 | | | |
| TYPE OF EDUCATIONAL ACTIVITY: Characterising | | | |
| TEACHER: Mario Iamarino | | | |
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| phone: 0971205208 | | mobile (optional): *n.a.* | |
| Language: Italian | | | |
| ECTS: 9<br><br>distributed as follows:<br>6 ECTS theory<br>3 ECTS exercise | n. of hours: 81<br><br>distributed as follows:<br>48 h theory<br>33 h exercise | Campus: Potenza<br><br>School: Engineering<br><br>Programme: Mechanical Engineering (Master's degree) | Semester: II |

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

**Knowledge and understanding**

Main objective is the acquisition of notions and tools to study and understand the most common chemical processes and plants used in the energy industry. To this goal, a first overview of fundamental concepts in chemical engineering will be given (chemical thermodynamics, kinetics and mass transfer phenomena in reacting systems, ideal chemical reactors, catalysts and multi-phase reacting systems). This will be followed by the main applications, namely combustion science and technology (chemical and thermodynamic aspects, pollutant formation, laminar and turbulent flames, autoignition, deflagration and detonation, combustion technologies for solid, gas and liquid fuels) and chemical processes for renewable energy generation, with focus on hydrogen and biofuels. To complement the theory, a quantitative approach will be pursued in the exercise sessions, through the resolution of mass and energy balances, the dimensioning of simple units, the optimization and integration of more complex schemes.

**Applying knowledge and understanding**

Capacity of abstraction will be stimulated in order for the student to be as much as possible autonomous when applying the proposed tools and method, even to cases and contexts different, to a reasonable extent, from those presented in the classes. To this goal, the exercise sessions will help verifying the capacity to apply the acquired knowledge. In such occasions, students will afford quantitative and design problems relevant to chemical processes and plants, in a more and more autonomous way. Students will be also stimulated to solve exercises in autonomy outside the class hours, and to discuss the results afterwards with teacher and other students.

**Making judgement**

At the end of the course, the student is supposed to be able to evaluate and compare in autonomy the different plant and process solutions considered, to highlight their pros and cons, to judge their suitability to different industrial contexts and practice and to identify acceptable operating conditions for such units. In this way, the student is encouraged to elaborate autonomously the concepts provided during the lessons, and to use the acquired knowledge as a basis to reach further conclusions and judgements.

**Communication skills**

During each lesson, the student is encouraged to interact with the teacher and to discuss with him about the concepts at hand. This will strengthen his ability to use the correct technical language commonly used in the chemical industry sector, both at national and international level, and will improve his communication skills. To this

goal, extracts from highly specialized books written in English and international scientific publications will be also used. The ultimate goal is to make the student aware of the technical jargon and confident to communicate technical topics, in a clear and unambiguous way, to a both specialized and non-specialized audience.

**Learning skills**
The student is encouraged to investigate further and in full autonomy any topics of major interest, including the consultation of additional specialized books, specialized internet sites, publications, etc.

PRE-REQUIREMENTS
Students are required to have basic knowledge of chemistry and applied physics concepts concerning chemical equilibria, stoichiometry, multi-phase systems, thermodynamics principles, heat exchange.

CONTENT

Chemical engineering principles (16 h)
Chemical kinetics, multi-phase equilibria, equilibria in reacting systems, mass transport phenomena in reacting systems. Mass and energy balances in reacting systems. Ideal chemical reactors and multi-reactor systems. Catalysts and gas-solid systems. Kinetics and mass transfer control.

Combustion science and technology (16 h)
Thermodynamics and kinetics of combustion reactions. Autoignition. Detonations and deflagrations. Laminar and turbulent flames. Technologies for gas, solid, liquid combustion. Pollutants formation and main abatement technologies.

Chemical processes for the energy industry (16 h)
Principal unit operations in the process industry, with focus on the energy industry. Chemical processes for the hydrogen and biofuel industry.

Exercise sessions (33 h)
Exercise sessions will be distributed along the entire course, for topics that require a quantitative or design approach.

TEACHING METHODS
The course duration is 81 hours (48 hours theory and 33 hours exercise sessions).

EVALUATION METHODS
Written + Oral exam
The written part consists of 2 exercises on topics which require a quantitative or design approach, consistently with what is done in the exercise sessions. It takes 3 hours.
The oral part will take place a few days later and only students who have passed the written part will be admitted.
The final outcome of the exam will depend on both the written and oral part.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL
Materiale fornito dal docente
C. Ortolani. Combustione. Ed. Maggioli
A.s. Foust, L.A. Wenzel, C.W. Clump, L. Maus, L.B. Andersen. I principi delle operazioni unitarie. Ed. Ambrosiana

INTERACTION WITH STUDENTS

Useful information and material will be given to the students during the classes.

Outside the classroom, the teacher is available to meet the students in his office each Wednesday between 13:00 and 15:00 and can be also reached anytime via email.

EXAMINATION SESSIONS (TENTATIVE)[1]

05/07/2018, 19/07/2018, 20/09/2018, 25/10/2018, 06/12/2018

SEMINARS BY EXTERNAL EXPERTS YES □ NO X

FURTHER INFORMATION

[1] Subject to possible changes: check the web site of the Teacher or the Department/School for updates.