COURSE DESCRIPTION
ADVANCED THERMODYNAMICS

SSD: PRINCIPI DI INGEGNERIA CHIMICA (ING-IND/24)

DEGREE PROGRAMME: BIOINGEGNERIA INDUSTRIALE (P16)
ACADEMIC YEAR 2024/2025

COURSE DESCRIPTION

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: U1597 - ADVANCED THERMODYNAMICS AND TRANSPORT PHENOMENA
MODULE: U1598 - ADVANCED THERMODYNAMICS
TEACHING LANGUAGE: INGLESE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER I
CFU: 6

REQUIRED PRELIMINARY COURSES

none

PREREQUISITES

There are no prerequisites.

LEARNING GOALS

Understanding complex and non-idealthermodynamic problems, relevant in bioengineering processes. Predict equilibrium conditions for complexsystems such as multicomponent multiphase systems and reacting systems.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student needs to show knowledge and understanding of the fundamental laws governing phase equilibria, both of pure substances and mixtures, and chemical equilibria. At the end of the learning process, the student will be able to solve problems of matter and energy balance, and of phase and reaction equilibria. Furthermore, t The course provides students with knowledge and basic methodological tools needed to use diagrams and tables for the determination of thermodynamic properties.

Applying knowledge and understanding

The course delivers ability and tools needed to apply knowledge in practice, favoring the ability to use methodological tools to solve simple problems concerning matter and energy balances, as well as phase and chemical equilibria.

COURSE CONTENT/SYLLABUS

Mass and energy balances in reacting systems. Application of firstand second law of thermodynamics to living systems. Non-ideal gases. Free energy. Chemical potential. Fugacity. Third law of thermodynamics.Phase equilibria, ideal mixtures. Phase diagrams. Vapor-Liquid Equilibrium. Raoult's law. Dewpoint andbubblepoint calculations.Chemical reaction equilibrium. Heats and energy of reaction and formation. Standard state in biochemistry. Reaction equilibria. Equilibrium law and "Le Chatelier's" principle. Advanced thermal balances and adiabatic reactors.

READINGS/BIBLIOGRAPHY

-J. M. Smith e H. C. Van Ness, Introduction to Chemical Engineering Thermodynamics, McGraw-Hill

- Lecture notes

TEACHING METHODS OF THE COURSE (OR MODULE)

The teacher will use: lectures for about 50 % of total hours and practical exercises for about 50% of total hours, problem solving and team working.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

- [x] Written
- [ ] Oral
- [ ] Project discussion
- [ ] Other

In case of a written exam, questions refer to

- [x] Multiple choice answers
- [ ] Open answers
- [x] Numerical exercises

b) Evaluation pattern

The evaluation will be based both on the results of the multiple choice tests (20%) and on the results of the numerical exercises (80%).