COURSE DESCRIPTION
THERMODINAMICS OF LIVING SYSTEMS

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

DEGREE PROGRAMME: BIOINGEGNERIA INDUSTRIALE (P16)
ACADEMIC YEAR 2023/2024

COURSE DESCRIPTION

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: U1583 - THERMODYNAMICS AND TRANSPORT PHENOMENA IN LIVING SYSTEMS
MODULE: U1584 - THERMODINAMICS OF LIVING SYSTEMS
TEACHING LANGUAGE: INGLESE
CHANNEL: FG A-Z
YEAR OF THE DEGREE PROGRAMME: I
PERIOD IN WHICH THE COURSE IS DELIVERED: SEMESTER II
CFU: 6

REQUIRED PRELIMINARY COURSES

None.

PREREQUISITES

There are no prerequisites.

LEARNING GOALS

Students will acquire fundamental concepts related to the application of thermodynamics to bioengineering problems, with special reference to phase equilibria for pure substances and mixtures, and chemical equilibria.
Students will be able to solve problems concerning mass and energy balances, and phase and reaction equilibria, relevant for bioengineering.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student is expected to acquire knowledge and understanding of problems related to the laws of thermodynamics, the equilibria between phases, both for pure substances and mixtures, and chemical equilibria of interest for bioengineering. The student is expected to know how to elaborate concepts concerning the relationships between thermodynamic quantities based on the laws of thermodynamics.

Applying knowledge and understanding

The student is expected to be able to acquire autonomously information required to solve problems concerning mass and energy balances, phase and reaction equilibria, and determination of thermodynamic properties by using diagrams and tables.

COURSE CONTENT/SYLLABUS

Reviews of the laws of thermodynamics. Chemical potential and fugacity. Phase equilibria. Chemical equilibria. Osmosis. Surface tension. Dialysis. Binding equilibria. Donnan equilibria. Electrolyte solutions. Adsorption. Membrane transport. Interfacial thermodynamics. Surfactants.

READINGS/BIBLIOGRAPHY

- *B. Alberts, A. Johnson, J. Lewis, D. Morgan, M. Raff, K. Roberts, P. Walter, Molecular Biology of the Cell, Garland Science*
- *H.-J. Butt, K. Graf, M. Kappl, Physics and Chemistry of Interfaces, Wiley-VCH*
- *P.-G. De Gennes, F. Brochard-Wyart, D. Quéré, Capillarity and Wetting Phenomena. Drops, Bubbles, Pearls, Waves, Springer*
- *Fournier, Ronald L. Basic Transport Phenomena in Biomedical Engineering, CRC Press*
- *J. M. Smith, H. C. Van Ness, M. M. Abbott, Introduction to Chemical Engineering Thermodynamics, Mcgraw Hill*
- *Teching material downloadable from the instructor's web page or from the course team.*

TEACHING METHODS OF THE COURSE (OR MODULE)

The course will include:
a) lectures for about 36 hours;
b) practical sessions and tutorials for about 12 hours.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

☑ Written

☐ Oral

- [x] Project discussion
- [ ] Other

In case of a written exam, questions refer to

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

b) Evaluation pattern