COURSE DESCRIPTION
ADVANCED TRANSPORT PHENOMENA

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

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

COURSE DESCRIPTION

TEACHER: PASQUINO ROSSANA
PHONE: 081-7682288
EMAIL: rossana.pasquino@unina.it

GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: U1597 - ADVANCED THERMODYNAMICS AND TRANSPORT PHENOMENA
MODULE: U1599 - ADVANCED TRANSPORT PHENOMENA
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

None

LEARNING GOALS

The student will learn to model transport phenomena in industrial engineering through mathematical methods and partial differential equations . Applications include fluid flow, convection, coupled heat and mass transfer.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student should be able to recognize and describe from a mathematical point of view complex problems concerning with the transport phenomena, by using the acquired knowledge on heat, mass and momentum transfer. He/she should be able to remember, write and resolve differential equations able to describe the main variables in the specific case study.

Applying knowledge and understanding

The studend must compare in a critical way the mathematical results with the physical interpretation of the problem. He/She must have acquired deep knowledge of the studied arguments and be able to show physical intuition on the obtained results. Finally, the student must have tha capabilities of manipulating the significant physical quantities in a way to find dimensionless groups able to describe the considered transport phenomenon.

COURSE CONTENT/SYLLABUS

Fundamentals of transport phenomena.

Fluid dynamics (momentum transfer). Macroscopic and microscopic balance of momentum; Navier-Stokes equations; dimensionless form of momentum balances; case studies, examples and exercises; flow past submerged objects

Mass transfer (chemical species transfer). Macroscopic and microscopic mass balances; mass balance for single chemical species; dimensionless form of the mass balance for chemical species; unsteady diffusion and examples; convective mass transport and exercises.

Heat transfer (energy tranfer). Microscopic balance of mechanical energy; Bernoulli equation and exercises; macroscopic and microscopic total energy balance; thermal energy balance and its dimensionless form; convective heat transport with exercises.

READINGS/BIBLIOGRAPHY

L R.B. Bird, W. E. Stewart, E. N. Lightfoot, Transport Phenomena, Wiley (2007)
L M. M. Denn, Process Fluid Mechanics, Prentice-Hall (1980)
L E.L. Cussler, Diffusion. Mass transfer in fluid systems, Cambridge University Press (1997)
L P. M. Doran, Bioprocess Engineering Principles, Academic Press (1995)

TEACHING METHODS OF THE COURSE (OR MODULE)

Most of the course will be taught via frontal lessons, with supporting slides. Some lessons will be totally dedicated to the practical resolution of complex transport phenomena exercises and previous written exams.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

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

In case of a written exam, questions refer to

- ☐ Multiple choice answers
- ☐ Open answers
- ☑ Numerical exercises

b) Evaluation pattern