COURSE DESCRIPTION
TRANSPORT PHENOMENA IN LIVING SYSTEMS

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

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

COURSE DESCRIPTION

TEACHER: AVALLONE PIETRO RENATO
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: U1583 - THERMODYNAMICS AND TRANSPORT PHENOMENA IN LIVING SYSTEMS
MODULE: U1585 - TRANSPORT PHENOMENA IN 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

None

LEARNING GOALS

The student will acquire in-depth knowledge of the balance equations relevant to living systems. With regard to fluid mechanics, emphasis will be placed on knowledge of the blood circulatory system, including the heart and vessels, the rheology of hydrogels with implications for tissue engineering, and the transport of chemical species across membranes and extracellular media.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student will acquire in-depth knowledge of the balance equations relevant to living systems. With regard to fluid mechanics, emphasis will be placed on knowledge of the blood circulatory system, including the heart and vessels, the rheology of hydrogels with implications for tissue engineering, and the transport of chemical species across membranes and extracellular media.

Applying knowledge and understanding

The student will acquire the ability to: solve fluid mechanics problems involving Newtonian and non-Newtonian fluids; use mechanical energy balances to perform macroscopic flow calculations in circulatory systems; calculate the flow of chemical species through biological media and membranes; and develop relationships between the rheological and microstructural properties of hydrogels.

COURSE CONTENT/SYLLABUS

- Momentum transfer: the blood circulatory system
- Mass transfer
- Diffusion
- Convective mass transport
- Mass transport in membranes
- Sol/Gel systems. Hydrogels
- Bioscaffolds. 3D printing
- Rheology

READINGS/BIBLIOGRAPHY

- John K-J Li, **Dynamics of the vascular system**, Series on Bioengineering &Biomedical Engineering - Vol. I, World Scientific Publishing 2004
- Mark Saltzman, **Drug Delivery: Engineering Principles for Drug Therapy**, Oxford University Press 2001
- H.A. Barnes, J.F. Hutton, KL. Walters, **An introduction to Rheology**, Elsevier, Amsterdam 1989
- Lecture notes, slides and additional material from the website.

TEACHING METHODS OF THE COURSE (OR MODULE)

The lecturer will use: a) theoretical lectures for approximately 50% of the total hours; b) practical exercise sessions for approximately 20% of the total hours; and c) lab sessions for approximately 30% of the total hours.
Lectures will be delivered via blackboard and PowerPoint.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

☐ Written

☐ Oral

- [ ] Project discussion
- [x] Other : Written and project presentation

In case of a written exam, questions refer to

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

b) Evaluation pattern

The final mark is given on the basis of a written test and a student-led seminar. For the latter, students are organised into groups of 3–5, to which a scientific work is assigned that points out the outline of the presentation. The final mark is the arithmetic mean of the two parts.