COURSE DESCRIPTION
SYSTEM ANALYSIS FOR BIOENGINEERING

SSD: BIOINGEGNERIA INDUSTRIALE (ING-IND/34)

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

COURSE DESCRIPTION

TEACHER: DI BERNARDO DIEGO
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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: NOT APPLICABLE
MODULE: NOT APPLICABLE
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 be introduced to the biochemical reactions and the law of mass action and their modelling in terms of ordinary differential equations and their analysis using Linear Dynamical Systems. Examples from molecular and cellular biology will be used thorughout the course.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

The student will learn how to write biochemical reactions and how to transform these into ordinary differential equations and how to analyse their behaviour using analaytical, qualitative and

numerical techniques derived from the Theory of Linear Dynamical Systems.

Applying knowledge and understanding
Given a set of biochemical reactions, the student will ba able to model and study their behaviour using analytical, qualitative and numerical (MATLAB) techniques.

COURSE CONTENT/SYLLABUS

The course gives an introduction to linear and non-linear systems analysis and control systems with biological applications. The class starts with an introduction to modelling with examples ranging from biochemical reactions to biomolecular circuits. The course will include the concept of state-space representation of dynamical systems in the time-domain using ordinary differential equations and difference equations, equilibrium point and its stability, and the mathematical tools for analytical, qualitative and numerical (MATLAB) analysis of linear and non-linear systems (free response, forced response, charateristic parameters). The course will conclude with an introduction to linear feedback control theory.

READINGS/BIBLIOGRAPHY

Lecture Notes available in PDF on the TEAMS course page.

(optional) Book: Introduction to Systems Biology, B. Ingalls

TEACHING METHODS OF THE COURSE (OR MODULE)

The course will consists of lectures using lecture handouts and PowerPoint presentations, and of practical sessions to solve problems using "pen and paper" and a computer with MATLAB for numerical simulations.

EXAMINATION/EVALUATION CRITERIA

a) Exam type

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

In case of a written exam, questions refer to

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

b) Evaluation pattern