

**ELENCO DEI CORSI DELLA SCUOLA DI DOTTORATO DEL
POLITECNICO DI BARI PER IL V BANDO
(A. A. 2022-2023)**

1) Stochastic approaches in Systems Biology, SSD ING-INF/04, 1.5 CFU.

Syllabus:

- The kind of chemical reactions, and their mathematical representation: the stoichiometric matrix. Mass action law and fluxes
- The stochastic approach: Chemical Master Equations (CME). CMEs modeled by Continuous-Time Markov Chains
- The Gillespie Algorithm
- Moment computations
- The Langevin equation
- Examples from enzymatic/metabolic reactions and gene transcription networks

2) Navigation systems for autonomous systems, SSD ING-INF/04, 1.5 CFU

Syllabus:

Introduction to the Navigation problem.
Reference frames.
Inertial sensor technologies: gyroscopes and accelerometers.
Non-inertial sensors: magnetometers, GPS etc.
Navigation Equations
Integrated inertial navigation systems.
Notions of visual-based navigation.
Examples.

3) Applications of MATLAB. ING-INF/04, 2 CFU.

Syllabus:

The course shall address the various functionalities of MATLAB with applications to engineering. The course participants will be able by the end of the course to use MATLAB autonomously.

Syllabus:

Environment of the MATLAB Software
Predefined functions
Working with matrices
Graphical functions
Functions defined by the user
Inputs and outputs controlled by the user

Control structures and logical functions
Symbolic math
Modeling and simulation in Simulink

4) Space Economy: past, present, future, SSD ING-IND/35, 2 CFU

Syllabus:

The Space Industry

1. The early days of the space industry
 - a. Sputnik
 - b. Apollo and Space Shuttle program
 - i. Deep dive on human spaceflight
2. Today's space industry
 - a. The aerospace band
 - b. International Space Station
 - c. Satellite platforms and satellite services
 - d. Rocket launchers: expendable, refurbishable, reusable
3. Short-term future
 - a. Artemis program for Moon exploration
 - b. Mars robotic exploration
 - c. In-space manufacturing and logistics
4. Long-term future
 - a. Permanent lunar and Martian habitats
 - b. Exploitation of extraterrestrial resources

The Space Economy

1. Domains of operation: civil, commercial, military
 - a. Deep dive on military space
2. Business opportunities in the New Space Economy
3. Space law: diplomacy, treaties, agreements
4. Space and finance: future markets
5. Space in Italy: organization, actors, and peculiarities

5) Organizational and regulations issues for operating and flying drones, ING-IND/35, 2 CFU

Syllabus:

Drone definitions and typologies - (4h)

Drone operations: precision agriculture, infrastructure inspection, wind energy monitoring, pipeline and power inspection, highway monitoring, natural resources monitoring, environmental; compliance, atmospheric research, media and entertainment, sport photos, filming, wildlife protection and research, hunting and anti-hunting monitoring, disaster relief - (4h)

Drone regulations: ICAO – EASA – ENAC – Regulations - (4h)

Concept of operations: open, specific and certified - (4h)

UASs space regulations: European, national regulation - (4h)