

## MATHEMATICAL METHODS

### 1.1. Identification

University:	Alma Mater Studiorum – Università di Bologna										
School:	School of Engineering										
Course:	Mathematical methods										
ECTS:	6										
Semester:	<i>Winter</i>			X	<i>Summer</i>						
Category	<i>Fundamental course</i>			X	<i>Specialisation course</i>						
Module	<i>MFI</i>		<i>MFII</i>		<i>MFIII</i>	X	<i>MSI</i>		<i>MSII</i>		<i>MSIII</i>
Teachers:	Fabio Ancona										
Language:	<i>English</i>	X	<i>Italian</i>	X	<i>Swedish</i>		<i>Spanish</i>				

### 1.2. Learning-outcomes

- To know and to be able to use some mathematical techniques for the information engineering

### 1.3. Competencies

1. To know the theory of linear differential equations and systems.
2. To be able to solve constant coefficient linear differential equations and systems.
3. To know the Laplace transform and its use in solving linear differential equations.
4. To have a basic knowledge of dynamical systems.

### 1.4. Contents

- Linear ordinary differential equations, Cauchy problem, existence and uniqueness of solutions.
- Laplace transform: definition, convergence abscissa. Formal properties of the Laplace transform. Laplace transforms of standard functions.
- Applications of Laplace transform to ordinary differential equations.
- Basic facts about linear transformations; eigenvalues, eigenvectors.
- Systems of linear differential equations. Matrix exponential.
- Dynamical systems, stability.
- Numerical solutions of differential equations.

### **1.5. Teaching Methodology**

- Lecture sessions.

### **1.6. Evaluation**

- Written and oral exams.

### **1.7. Bibliography**

1. M. Tenenbaum & H. Pollard, Ordinary Differential Equations, Dover (1985).