



### Programme of Course "Control systems"

- Code: I0062
- Type of course unit: Compulsory (Master Degree in Mathematical Engineering curriculum Comune)
- Level of course unit: Postgraduate Degrees
- Semester: 1

Number of ects credits: (Master Degree in Mathematical Engineering) 6 (workload 150 hours)

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<b>1</b>	<b>Course objectives</b>	The course provides the basic methodologies for modeling, analysis and controller design for continuous-time linear time-invariant systems.
<b>2</b>	<b>Course content and learning outcomes (dublin descriptors)</b>	<p>Topics of the module include:</p> <ul style="list-style-type: none"> <li>• Frequency domain models of Linear Systems: Laplace Transform, Transfer Function, Block diagrams.</li> <li>• Time domain models of Linear Systems: State space representation. BIBO stability.</li> <li>• Control specifications for transient and steady-state responses. Polynomial and sinusoidal disturbances rejection.</li> <li>• The Routh-Hurwitz Criterion. PID controllers.</li> <li>• Analysis and controller design using the root locus.</li> <li>• Analysis and controller design using the eigenvalues assignment: controllability, observability, the separation principle.</li> <li>• Reference inputs in state space representations.</li> <li>• Controller design using MATLAB.</li> <li>• Advanced topics in control theory.</li> </ul> <p>On successful completion of this module, the student should :</p> <ul style="list-style-type: none"> <li>• On successful completion of this module, the student should:</li> <li>• have knowledge and understanding of characteristics and properties regarding feedback control systems</li> <li>• have knowledge and understanding of frequency- and time-domain modeling frameworks for feedback control systems</li> <li>• have knowledge and understanding of stability, transient and steady-state properties of feedback control systems, as well as metrics for characterising such properties</li> <li>• have knowledge and understating of methods for designing controllers of feedback control systems, both in frequency and time-domains, both in the analog and digital cases</li> <li>• demonstrate capacity to design a control system architecture and a controller given a dynamical model of a plant and a set of specifications to be satisfied</li> <li>• demonstrate capacity, when designing a control system architecture and a controller, to relate the design choices to practical constraints and performance metrics induced by a specific application domain</li> <li>• be able to browse quickly or read carefully both technical and scientific papers or to attend conferences and seminars to increase his knowledge by choosing topics he may be interested in.</li> </ul>
<b>3</b>	<b>Course prerequisites</b>	Mathematical analysis

4	<b>Teaching methods and language</b>	Theory classes and exercise classes <b>Language:</b> English <b>Reference textbooks</b> <ul style="list-style-type: none"><li>• R. C. Dorf, R. H. Bishop, <i>Modern Control Systems</i>. Prentice Hall. 2008.</li></ul>
5	<b>Assessment methods</b>	Written and oral tests. The written test consists of two applicative exercises and one theoretical question, and will last 2 hours. The oral test will be held the same day of the written test. No computers, books, or notes are allowed.