Course Outline

COURSE TITLE	Automatic Control
NAME OF LECTURER	Andrea Bareggi

COURSE DESCRIPTION

This course is designed to introduce students to linear system dynamics and control as a fundamental approach to automatics in engineering.

Automatic control is essential in any field of engineering and science, such as space-vehicle systems, robotic systems, modern manufacturing systems, and any industrial operations involving control of temperature, pressure, humidity, flow, etc.

It is desirable that most engineers and scientists are familiar with theory and practice of automatic control. This course is addressed to senior electrical, mechanical, aerospace, or production engineering students.

Students are expected to have fulfilled the following prerequisites: introductory courses on differential equations, Laplace transforms, vector and matrix analysis, electrical circuit analysis, mechanics, and introductory thermodynamics. The course has been arranged toward facilitating the student’s gradual understanding of control theory. Highly mathematical arguments are carefully avoided in the presentation of the materials. On the other hand, a practical and computer based approach to engineering problems is preferred.

RECOMMENDED READINGS

Modern Control Engineering – link :
http://www.mediafire.com/file/67239sffewqyjw6/ModernControlEngineering.pdf/file

Scilab presentation for beginners – link :
https://homepages.laas.fr/yariba/enseignement/slides-but.pdf

Computer based exercises for Scilab – link :
https://scilabdotninja.wordpress.com/scilab-control-engineering-basics/

TEACHING METHODS

The pedagogical approach is based on three different teaching methods: top-down approach for the theoretical classes, interactive approach and student discussion for the paper based exercises, reversed classroom for the computer based exercises.

ASSESSMENT METHODS

Mid term exam 25%, Final exam 30%, Homework Assignments 25%, Class Participation 20%

CLASS TOPICS *(each class is 3 hrs)*

Class 1: Introduction to control of Linear Time Invariant (LTI) dynamic SISO systems

Class 2: Time response of 1st and 2nd order systems + computer based exercises

Class 3: Frequency response of 1st and 2nd order systems + computer based exercises

Class 4: **Computer Based Homework** - Transfer Functions and Frequency response

Class 5: Block diagrams and closed loop LTI system stability

Class 6: practical examples and exercises (paper and computer based)

Class 7: **Mid-term Exam**

Class 8: correction and computer based exercise : Feedback systems properties

Class 9: Introduction to multiple input/output LTI Systems : a space state approach

Class 10: PID Control and control design strategies

Class 11: **Computer Based Homework** - PID control

Class 12: correction and Computer based exercise: State Feedback control

Class 13: practical examples and exercises (paper and computer based)

Class 14: **Final Exam**

Class 15: correction and a short introduction to Optimal Control (LQR methods)

SPECIAL COMMENTS

Course Materials: video projector with HDMI cable (and VGA adapter), whiteboard and markers, internet connection. All students have access to a PC or laptop with Scilab 6.0 previously installed – link: https://www.scilab.org