Universitat de Lleida

DEGREE CURRICULUM

SYSTEMS INTEGRATION I

Coordination: PALLEJÀ CABRÉ, TOMÀS

Academic year 2018-19

SYSTEMS INTEGRATION I 2018-19

Subject's general information

<table>
<tr><td>Subject name</td><td>SYSTEMS INTEGRATION I</td></tr>
<tr><td>Code</td><td>102130</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Automation and Industrial Electronic Engineering</td><td>4</td><td>OPTIONAL</td><td>Attendance-based</td></tr>
</table>
</td></tr>
<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRAULA</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>3</td><td>3</td></tr>
<tr><th>Number of groups</th><td>1</td><td>1</td></tr>
</table>
</td></tr>
<tr><td>Coordination</td><td>PALLEJÀ CABRÉ, TOMÀS</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>(40%) 60 h classroom
(60%) 90 h autonomous work</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>English 100 %
Spanish 0%
Catalan 0%</td></tr>
<tr><td>Distribution of credits</td><td>Theoretical sessions: 1 ECTS
Experimental training sessions: 5 ECTS</td></tr>
<tr><td>Office and hour of attention</td><td>Robotics Lab (2.04-EPS building). Monday 10:00-11:00 AM.</td></tr>
</table>

SYSTEMS INTEGRATION I 2018-19

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
PALLEJÀ CABRÉ, TOMÀS	tpalleja@diei.udl.cat	7,2	

Subject's extra information

It is **highly recommended** that the students have approved DISCRETE PROCESSES before doing SYSTEM INTEGRATION I. If not, they wont have the basic knowledge and it will be very difficult to get the maximum score. In this case, students can study discret processing by themself, focussing on Z-Transform and PID digitaliztion.

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Blue laboratory gown from UdL (unisex)
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

http://www.publicacions.udl.cat/

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

Learning objectives

- Obtain the transfer function of an unknown system
- Digitalize transfer functions (from s-domine to z-domine)
- Design digital controllers
- Program microprocessors (Arduino DUE)
- Designing and program interfaces in C#
- Serial communication

Competences

Strategic Competences of the UdL

UdL2. Command of a foreign language.

UdL3. Mastering ICT's.

Cross-disciplinary competences

EPS4. To have the skills required to undertake new studies or improve the training with self-direction.

EPS9. Capacity for unidisciplinary and multidisciplinary teamwork.

Specific competences

GEEIA21. Knowledge of the basics and applications of the digital electronics and microprocessors.

GEEIA25. Knowledge and capacity for modelling and simulation of systems.

GEEIA27. Knowledge of principles and applications of robotic systems.

Subject contents

1 Microprocessor

1.1 Introduction

1.2 Interruptions

1.3 Timers

1.4 PWM

2 Interface

- 2.1 Introduction to VisualStudio
- 2.2 Introduction to C #
- 2.3 Programming by events
- 2.4 Generation of graphs
- 2.5 Files.
- 2.6 Inputs generation

3 Communication

- 3.1 Serial port
- 3.2 Microprocessor - HyperTerminal
- 3.3 Microprocessor - Interface

4 Plant

- 4.1 DC motors
- 4.2 Encoder (sensors hall)

5 Feedback

- 5.1 Obtaining the pulses of the encoder
- 5.2 Position estimation
- 5.2 Speed estimation

6 Controller design

- 6.1 Obtain the plant
- 6.2 Define design constraints
- 6.3 Calculate PID controller
- 6.4 Programming PID controller

7 Results validation

- 7.1 Estimate the error in the stationary state
- 7.2 Estimate the peak time
- 7.3 Estimate over pic value

7.4 Estimate the settlement time

Methodology

The subject will be developed by conducting several experimental works to be carried out in the electronics lab 2.05 (2nd floor) of the Polytechnic School (EPS).

Development kits will be provided entirely by the school where each student will work individually.

Practical exercises will be based on microcontroller programming using Arduino

Each class will be divided in two stages, theory (25%) and experimental training with teacher support (75%)

Development plan

Week	Description;	Classroom Activity	Classroom/independent work
1	Lecture and problems	Lesson 1	4h/6h
2	Lecture and problems	Lesson 1	4h/6h
3	Lecture and problems	Lesson 2	4h/6h
4	Lecture and problems	Lesson 2	4h/6h
5	Lecture and problems	Lesson 3	4h/6h
6	Lecture and problems	Lesson 3	4h/6h
7	Lecture and problems	Lesson 4	4h/6h
8	Lecture and problems	Lesson 4	4h/6h
9	Oral test	**First mid-term exam**	2h/3h
10	Lecture and problems	Lesson 5	4h/6h
11	Lecture and problems	Lesson 5	4h/6h
12	Lecture and problems	Lesson 6	4h/6h
13	Lecture and problems	Lesson 6	4h/6h
14	Lecture and problems	Lesson 7	4h/6h
15	Lecture and problems	Lesson 7	4h/6h
16	Oral tests	**Second mid-term exam**	2h/3h
17			
18			
19	Oral tests	**Recovery exam**	

Evaluation

The course has two oral tests of 20 minutes each where the student defends his project (in English), and two written technical reports. To assign an impartial and fair mark, each test has a set of objectives that are weighted depending on its difficulty.

1st Presentation mark: **FP** (18%) 1st Report mark: **R1** (12%) 2nd Presentation mark: **SP** (42%) 2nd Report mark: **R2** (28%)

Case	*Tests marks*	*Final mark calculation*
A)	if (**SP** ≥ 5 and **R2** ≥ 5)	**FP** 0.18 + **SP** 0.42 + **R1** 0.12 + **R2** 0.28
B)	if (**SP** < 5)	**SP** *(fail)*
C)	if (**R2** < 5)	**R2** *(fail)*

In case of failing the course, the student will be entitled to present a resitting oral test (60%) and a final report (40%) including all the topics of the course. In this case, the maximum mark will not be higher than 69%.

Bibliography

https://www.arduino.cc/

Katsuhiko Ogata. (1994). Discrete-Time Control Sistems (2 nd Edition). Prentice-Hall, Inc.