Course guide
820039 - MCSBB - Modelling and Control of Biomedical Systems

Unit in charge: Barcelona East School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.
Degree: BACHELOR’S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Optional subject).
Academic year: 2023 ECTS Credits: 6.0 Languages: English

LECTURER
Coordinating lecturer: MARIA MONTSERRAT VALLVERDU FERRER
Others: Segon quadrimestre: PEDRO GOMIS ROMAN - T10 MARIA MONTSERRAT VALLVERDU FERRER - T10

PRIOR SKILLS
There are no prerequisites.

REQUIREMENTS
There are not

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.

TEACHING METHODOLOGY
The course uses participative lectures by 15%, the project-based learning by 35% and teamwork by 50%. Entire course will be held in a computer lab.

LEARNING OBJECTIVES OF THE SUBJECT
At the end of the course, the student will be able to:

- Analyze the behavior of a dynamical system; use software tools; design models to understand its performance; evaluate various strategies for its operation.
- Apply proper working methods of modeling biomedical systems, so that can be applied to solve problems in the field of biomedical engineering but also in general engineering.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>45.00</td>
<td>30.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Self study</td>
<td>90.00</td>
<td>60.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

T1: Mathematical Modeling

Description:
Generalized system properties. Linear models of biomedical systems. Computer analysis and simulation using MATLAB and SIMULINK.

Related activities:
Lectures and laboratory work in computer lab room including guided projects.

Full-or-part-time: 30h
Theory classes: 7h 30m
Laboratory classes: 4h 30m
Self study: 18h

T2: Analysis of Biomedical Systems Using Linear Models

Description:

Related activities:
Lectures and laboratory work in computer lab room including guided projects.

Full-or-part-time: 22h
Theory classes: 5h
Laboratory classes: 3h
Self study: 14h

T3: Identification of Biomedical Control Systems

Description:

Related activities:
Lectures and laboratory work in computer lab room including guided projects.

Full-or-part-time: 26h
Theory classes: 7h 30m
Laboratory classes: 4h 30m
Self study: 14h
T4: Optimization in Biomedical System Control

**Description:**
Application to models of biomedical systems: Optimization in systems with negative feedback; Single-parameter optimization; Constrained optimization.

**Related activities:**
Lectures and laboratory work in computer lab room including guided projects.

**Full-or-part-time:** 18h
Theory classes: 2h 30m
Laboratory classes: 1h 30m
Self study: 14h

T5: Nonlinear Analysis of Biomedical Control Systems: Complex Dynamics

**Description:**

**Related activities:**
Lectures and laboratory work in computer lab room including guided projects.

**Full-or-part-time:** 16h
Theory classes: 2h 30m
Laboratory classes: 1h 30m
Self study: 12h

T6: Application of modeling techniques to biomedical systems

**Description:**
Several models of biomedical systems will be developed in Matlab and Simulink. Tools of modeling and simulation will be applied. Various strategies for its operation will be evaluated.

**Related activities:**
Lectures and laboratory work in computer lab room including guided projects.

**Full-or-part-time:** 38h
Theory classes: 12h 30m
Laboratory classes: 7h 30m
Self study: 18h

**GRADING SYSTEM**

La evaluación se realizará mediante la valoración por parte del profesorado de las siguientes partes:

- Entregables correspondientes a la parte de teoría (NLL): 30%
- Prácticas de Laboratorio incluyendo los informes entregados de cada sesión (NLab): 30%
- Trabajo final realizado en grupo (NTF): 35%
- Evaluación de la competencia genérica (NCG): 5%

No habrá pruebas de exámenes parciales ni finales

Nota final = 0,3 NLL + 0,3 NLab + 0,35 NTF + 0,05 NCG
EXAMINATION RULES.

- In theory class, deliverables guided exercises will be developed, conducted individually or in groups of 2 students.
- The lab will be assessed based on class attendance and delivery of practice reports. Practices can be individual or in groups of 2 students.
- The final work will take place individually or in groups of 2 students. Students may choose the final work with the advice and approval of the teacher. It will be presented orally with audiovisual support. Generic competence will be evaluated.

If it is not done any of the activities of the laboratory or deliverable of continuous assessment, it will be considered as not scored.

BIBLIOGRAPHY

Basic: