Last update: 15-06-2018

820039 - MCSBB - Modelling and Control of Biomedical Systems

Coordinating unit: 295 - EEBE - Barcelona East School of Engineering

Teaching unit: 707 - ESAII - Department of Automatic Control

Academic year: 2018

Degree: BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)
BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional)

ECTS credits: 6 Teaching languages: Catalan, Spanish

Teaching staff

Coordinator: Montserrat Vallverdú

Others: Pedro Gomis

Opening hours

Timetable: Teachers' e-mail and timetable are published in ATENEA. Through the mail can be requested to arrange hours of individualized attention.

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.

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Study load

Total learning time: 150h	Hours large group:	45h	30.00%
	Hours small group:	15h	10.00%
	Self study:	90h	60.00%

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Content

T1: Mathematical Modeling

Learning time: 30h

Theory classes: 7h 30m
Laboratory classes: 4h 30m
Self study : 18h

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.

T2: Analysis of Biomedical Systems Using Linear Models

Learning time: 22h

Theory classes: 5h
Laboratory classes: 3h
Self study : 14h

Description:
Steady-state analysis. Time-domain analysis. Frequency-domain analysis. Stability analysis.

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

T3: Identification of Biomedical Control Systems

Learning time: 26h

Theory classes: 7h 30m
Laboratory classes: 4h 30m
Self study : 14h

Description:
Basic problems in biomedical system analysis. Identification methods. Parameter estimation. Identification of physiological systems.

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

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T4: Optimization in Biomedical System Control

Learning time: 18h

Theory classes: 2h 30m
Laboratory classes: 1h 30m
Self study : 14h

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.

T5: Nonlinear Analysis of Biomedical Control Systems: Complex Dynamics

Learning time: 16h

Theory classes: 2h 30m
Laboratory classes: 1h 30m
Guided activities: 0h
Self study : 12h

Description:
Nonlinear versus linear systems. Nonlinear oscillators. Model of the cardiovascular variability. Model of the circadian rhythms.

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

T6: Application of modeling techniques to biomedical systems

Learning time: 38h

Theory classes: 12h 30m
Laboratory classes: 7h 30m
Self study : 18h

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.

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Qualification 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

Regulations for carrying out activities

· 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:

Northrop, R. B. Endogenous and exogenous regulation and control of physiological systems. Boca Raton, FL [etc.]: Chapman & Hall/CRC, cop. 2000. ISBN 0849396948.

Ljung, L. System identification : theory for the user. 2nd ed. Englewood Cliffs: Prentice-Hall, 1999. ISBN 0136566952.

Solé Vicente, R.; Manrubia, S. C. Orden y caos en sistemas complejos. Barcelona: Edicions UPC, 2001. ISBN 8483014912.

IEEE Transactions on Biomedical Engineering [on line]. New York, NY: Antennas and Propagation Society of the Institute of Electrical and Electronics Engineers, 1988- [Consultation: 16/07/2013]. Available on: <http://ieeexplore.ieee.org/servlet/opac?punumber=10>.

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Medical & biological engineering & computing [on line]. Berlin: Springer, 1963- [Consultation: 16/07/2013]. Available on: <http://www.springerlink.com/content/1741-0444/?sortorder=asc&p_o=234>.

European journal of applied physiology [on line]. Berlin: Springer-Verlag, [2000]- [Consultation: 16/07/2013]. Available on: <http://www.springerlink.com/openurl.asp?genre=journal&issn=1439-6319>.

Medical engineering & physics [on line]. New York, NY: Elsevier Science Pub. Co., [19??]- [Consultation: 16/07/2013]. Available on: <http://www.sciencedirect.com/science/journal/13504533>.