COMILLAS
UNIVERSIDAD PONTIFICIA
ICAI ICADE CIHS

Syllabus
2024 - 2025

GENERAL INFORMATION

Data of the subject	
Subject name	Dynamic Systems
Subject code	DEA-GITI-313
Mainprogram	Bachelor's Degree in Engineering for Industrial Technologies
Involved programs	Grado en Ingeniería en Tecnologías Industriales y Grado en Administración y Dirección de Empresas [Third year] Grado en Ingeniería en Tecnologías Industriales [Third year]
Level	Reglada Grado Europeo
Quarter	Semestral
Credits	6,0 ECTS
Type	Obligatoria (Grado)
Department	Department of Electronics, Control and Communications
Coordinator	Ramón Rodríguez Pecharromán
Schedule	See web
Office hours	Send e-mail to get an appointment
Course overview	Introduction to Dynamic Systems. Modeling and analysis in both time and frequency domains of LTI systems.

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DESCRIPTION OF THE SUBJECT

Contextualization of the subject

Prerequisites

Basic knowledge of Physics, electric and electronic circuits and mechanical systems.

Course contents

Contents

FUNDAMENTALS

1. INTRODUCTION TO DYNAMIC SYSTEMS

1.1 Concept of system, signal and model.

1.2 Model applications.

1.3 Properties of models and systems.

1.4 Modeling of Linear-Time-Invariant (LTI) Systems.

2. LAPLACE TRANSFORM

2.1 Uses of the Laplace Transform.

2.2 Definition of the Laplace Transform.

2.3 Properties of the Laplace Transform.

2.4 Laplace Transform of basic functions.

2.5 Inverse Laplace Transform.

2.6 Relationship between poles and time response.

2.7 Determination of the time response from the differential equation.

2.8 Classification of time-response terms.

3. TRANSFER FUNCTION

3.1 Forced and natural responses.

3.2 Transfer Function definition.

3.3 Stability.

3.4 Routh-Hurwitz stability criterion.

3.5 Steady state: DC gain and frequency response.

3.6 Block diagrams.

REAL-WORLD SYSTEM MODELING. ANALYSIS OF LOW-ORDER SYSTEMS

4. REAL-WORLD SYSTEM MODELING

4.1 Electric circuits.

4.2 Electronic circuits based on operational amplifiers.

4.3 Translational mechanical systems.

4.4 Rotational mechanical systems.

4.5 Thermal systems.

5. FIRST-ORDER SYSTEMS

5.1 First-order systems.

5.2 Step response of first-order systems.

5.3 Frequency response: the Bode diagram.

5.4 Bode diagram of first order systems.

5.5 Asymptotic Bode diagram of systems composed of first-order terms.

5.6 Relationship between time response and frequency response.

6. SECOND-ORDER SYSTEMS

6.1 Second-order systems.

6.2 Time response of second-order systems.

6.3 Influence of an additional pole or zero to the standard second-order system.

6.4 Bode diagram of a second-order system.

6.5 Bode diagram of higher-order systems.

LABORATORY

LAB PROJECTS

P1. Analysis and simulation tools for dynamic systems: Matlab and Simulink.

P2. Design and analysis of second-order filters based on a Sallen-Key circuit setup, in both the time and the frequency domains.

EVALUATION AND CRITERIA

Evaluation activities	Evaluation criteria	Weight
Mid-term and final exams (individual)	• Understanding concepts. • Problem solving. • Problem-solving results assesment. • Writing.	65
Continuous evaluation quizzes (individual)	• Understanding concepts. • Problem solving. • Problem-solving results assesment.	10
Lab sessions (group)	• Understanding concepts. • Lab sessions performance. • Lab sessions results assesment. • Teamworking skill. • Writing	25

Grading

ORDINARY

In the ordinary period grading is composed of:

- Final exam: 45%. A minimum grade of 5 is required on the final exam to pass the course.
- Mid-term exam: 20%.
- Continuous evaluation quizzes: 10%
- Lab: 25%. A minimum grade of 5 is required to pass the course.

In case of failing, the re-take exam may include both theory and lab contents.

EXTRAORDINARY (RE-TAKE) EXAM

In the re-take exam grading is composed of:

- Re-take exam: 55%. A minimum grade of 5 is required on the final exam to pass the course.
- Mid-term exam: 15%.
- Continuous evaluation quizzes: 5%
- Lab: 25%. A minimum grade of 5 is required to pass the course.

ATTENDANCE RULES

Class attendance is mandatory, according to the Academic Regulations of the Higher Technical School of Engineering (ICAI). The requirements of attendance will be applied independently for theory and laboratory sessions:

- In the case of theory sessions, failure to comply with this rule may prevent the student from taking the exam in the ordinary period.
- In the case of laboratory sessions, failure to comply with this rule may prevent the student from taking the exam both in the normal and in the re-take periods.
- In any case, unjustified absences from laboratory sessions will be penalized in the grading.

BIBLIOGRAPHY AND RESOURCES

Basic References

- Notes provided by the instructor in the course web page.
- N. S. Nise. Control Systems Engineering, 8th Edition. Wiley. 2019.