Course guide
280675 - 280675 - Regulation and Automatic Control

Last modified: 27/05/2024

Unit in charge: Barcelona School of Nautical Studies
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR'S DEGREE IN NAVAL SYSTEMS AND TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 4.5 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: SERGIO ROMERO LAFUENTE

Others: Segon quadrimestre:
SERGIO ROMERO LAFUENTE - GESTN

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge of the theory of automatic control methods and their application on board.

TEACHING METHODOLOGY

· Receive, understand and synthesize knowledge
· Consider and solve problems
· Analyze results
· Perform work in a team and individually

LEARNING OBJECTIVES OF THE SUBJECT

The main objective is to provide the concept of a dynamic system, aplicable in practically all fields of engineering, and the signal as a variable of this system. Other objectives include:
· Introduction to the basic concepts and tools of system analysis.
· Design of controllers to improve the performance specifications of the systems.
· Presentation of control systems within the naval field.

At the end of the course the student must be able to perform the analysis and modification of the systems behavior in naval technology.

STUDY LOAD

Type	Hours	Percentage
Guided activities	6,0	5.33
Hours small group	9,0	8.00
Hours medium group	15,0	13.33
Self study	67,5	60.00
Hours large group	15,0	13.33

Total learning time: 112.5 h

CONTENTS

Introduction to automatic

Description:
Objective and scope of the subject. Feedback systems. Examples of dynamic systems in a ship.

Full-or-part-time: 3h 30m
Theory classes: 1h 30m
Self study : 2h

System modeling

Description:
Transfer function of linear systems. Canonical gain, poles and zeros. Block diagrams. Block algebra.

Full-or-part-time: 13h 45m
Theory classes: 3h 30m
Practical classes: 2h
Self study : 8h 15m

Time response

Description:
Impulse and step responses of first and second order systems. Stationary error of feedback systems.

Full-or-part-time: 22h 30m
Theory classes: 6h
Practical classes: 3h
Self study : 13h 30m

System stability

Description:
Definition of stability. Necessary and sufficient condition. Routh criterion.

Full-or-part-time: 9h 15m
Theory classes: 2h
Practical classes: 2h
Self study : 5h 15m

Design of PID controllers

Description:
PID controllers. Basic control actions. Effect of the actions of the P, I and D controls. Design of PID controllers.

Related activities:
Lab 1: Introduction and control system of the angular velocity of a DC motor. In this session the student has to: 1) Understand the system and the function of the different blocks of the plant; 2) Identify the model of the plant; 3) Evaluate the performance of different control systems in open and closed loop; and 4) Understand the effect of the different actions of proportional, integral and derivative controls.

Lab 2: Control system for the angular position of a DC motor. In this session the student has to: 1) Evaluate the performance of different systems in open and closed loop; and 2) Design a PID controller.

Full-or-part-time: 22h 15m
Theory classes: 2h
Practical classes: 3h 30m
Laboratory classes: 4h
Guided activities: 6h
Self study : 6h 45m

Frequency response

Description:
Gain and phase. Bode diagram. Frequency response of the canonical elements. Bode diagram of a general system. Polar diagram.

Full-or-part-time: 27h 30m
Theory classes: 7h
Practical classes: 4h
Self study : 16h 30m

Stability in the frequency domain

Description:
Nyquist criterion. Gain and phase margins.

Full-or-part-time: 13h 45m
Theory classes: 3h 30m
Practical classes: 2h
Self study : 8h 15m

GRADING SYSTEM

The final mark is the partial sum of the following qualifications:
Nfinal: 0.45 Npf + 0.4 Nac + 0.15 Nel

Nfinal: Final result
Npf: Final exam qualification
Nac: Continuous evaluation
Nel: Laboratory qualification

The final exam consists of questions on concepts associated with the learning objectives of the course, and a set of practice exercises. Continuous evaluation is the result of a partial test (with a weight of 20% of the final mark) and activities conducted during the year.

Reexamination: According to the rules of the FNB, a reexamination test consisting of a comprehensive review of the subject will be performed. This test reassessment is aimed to students with a final mark ranging between 3.0 and 4.9.

EXAMINATION RULES.

· Students who do not submit the final test, or have not done any of the labs, or have not submitted any test of the continuous evaluation wil be denoted as "NOT TAKEN".

BIBLIOGRAPHY

Basic:
- Ogata, Katsuhiko. Ingeniería de control moderna [on line]. 5a ed. Madrid: Pearson Educación, 2010 [Consultation: 01/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1259. ISBN 9788483226605.

Complementary:
- Dorf, Richard C. Sistemas automáticos de control: teoría y pràctica. Mexico: Addison Wesley Iberoamericana, 1986. ISBN 9688580449.

RESOURCES

Other resources:
Notes of theory and problems of the subject (Digital Campus Atenea).