Course guide
280616 - 280616 - Automatic Regulation and Control

Last modified: 17/10/2024

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

Degree: BACHELOR'S DEGREE IN NAUTICAL SCIENCE AND MARITIME TRANSPORT (Syllabus 2010). (Compulsory subject).

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

LECTURER

Coordinating lecturer: ROSA M. FERNANDEZ CANTI

Others: Segon quadrimestre:
ROSA M. FERNANDEZ CANTI - GNTM
YÁÑEZ SAURA, GINÉS - GNTM

PRIOR SKILLS

Complex numbers, modulus and phase
Differential equations
Laplace Transform

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge, use and application of automation and control methods applicable to the ship and offshore installations.

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 achieve 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 navigation technology.

STUDY LOAD

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

Total learning time: 112.5 h

CONTENTS

Introduction to automatic control

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

Modeling of systems

Description:
Mathematical background: Complex numbers, differential equations and Laplace Transform.
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. Steady state error.

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

Frequency response

Description:
Gain and phase. Bode diagram. Polar diagram.

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

System stability

Description:
Definition of stability. Necessary and sufficient condition. Routh criterion.
Evans Root Locus.
Nyquist criterion. Gain and phase margin

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

Design of PID controllers

Description:
PID controllers. Effects of P, I and D actions. Design of PID controllers.

Specific objectives:

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

GRADING SYSTEM

The final mark is the partial sum of the following qualifications:
Nfinal = 0,4 Npf + 0,2 Nac + 0,25 Nad + 0,15 NeL

Nfinal: Final result
Npf: Final exam qualification
Nac: Continuous evaluation
Nad: Work
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 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".
· Class attendance will be taken into acount positively.

BIBLIOGRAPHY

Basic:
- Villà Millaruelo, Ricard. Dinàmica de sistemes. Barcelona: Servei Gràfics Copisteria Imatge (UPC), 2012.
- Ogata, Katsuhiko. Ingeniería de control moderna [on line]. 5a ed. Madrid: Pearson education, 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, R. Sistemas automáticos de control: teoría y pràctica. Bogotá: Addison Wesley Iberoamericana, 1986. ISBN 9688580449.

RESOURCES

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