Course guides
230251 - RAD - Radar

Last modified: 29/04/2020

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 739 - TSC - Department of Signal Theory and Communications.

Degree: BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN TELECOMMUNICATIONS SCIENCE AND TECHNOLOGY (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN TELECOMMUNICATIONS TECHNOLOGIES AND SERVICES ENGINEERING (Syllabus 2015). (Optional subject).

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, English, Spanish

LECTURER

Coordinating lecturer: ANTONI BROQUETAS

Others: Broquetas Ibars, Antoni

PRIOR SKILLS

Radiation and Propagation, Signals and Systems, Probability and Stochastic Processes

TEACHING METHODOLOGY

- Lectures
- Application classes
- Exercises

LEARNING OBJECTIVES OF THE SUBJECT

We present the fundamentals and techniques of radio detection, location and estimation of parameters of distant bodies. The course has a telecom. system orientation combining a wide range of technical disciplines seen in previous courses applied to aerospace, navigation and industrial needs.

STUDY LOAD

Type	Hours	Percentage
Self study	98,0	65.33
Hours large group	52,0	34.67

Total learning time: 150 h

CONTENTS

1. Introduction: Radar and Telecommunications

Description:
Radar: A case of telecommunication system. Historical milestones in the development of radar. Types and examples of radar.

Full-or-part-time: 16h
Theory classes: 8h
Self study : 8h

2. Pulsed Radars

Description:
Basic principles of operation. Block diagram of a pulsed radar. The spatial exploration of radars: 2D and 3D systems. Resolution in range and angle. Radar Range (Power) equation: Radar Cross Section. The radar receiver. Matched Filter. Radar Detection: Probabilities of detection and false alarm. Pulse Integration. Applications in aerospace and marine navigation.

Full-or-part-time: 48h
Theory classes: 24h
Self study : 24h

3. Continuous Wave Radars

Description:
Doppler radar. Block diagram of a CW radar. Determination of the target velocity. FM-CW radar: Determination of target range and velocity. Examples and Applications.

Full-or-part-time: 16h
Theory classes: 8h
Self study : 8h

4. Pulse compression

Description:
The Dilemma of Energy and Resolution. Passive techniques and active compression pulses. Equation power radar pulse compression. The radar ambiguity function and properties. Resolution and precision in the estimates of distance and speed. Xirp signal analysis and coded pulses (Barker, Frank, etc.).

Full-or-part-time: 24h
Theory classes: 12h
Self study : 12h

5. Moving Target Detection

Description:
Interference caused by the target environment (Clutter), properties and models. Coherent techniques for detecting moving targets: MTI, MTD. Adaptive threshold detectors: Temporal and Spatial CFAR detectors. Characterization of coherent and incoherent detection techniques. Examples and Applications.

Full-or-part-time: 23h
Theory classes: 6h
Practical classes: 2h
Self study : 15h

ACTIVITIES

EXERCISES

Description:
Collection of problems (with solutions)

Full-or-part-time: 26h
Theory classes: 26h

CONTROL based on problem solutions

Description:
Short mid-term test at the end of Chap.2

Full-or-part-time: 1h 30m
Theory classes: 1h 30m

EXTENDED ANSWER TEST (FINAL EXAMINATION)

Description:
Final Exam. Based on problems solution.

Full-or-part-time: 2h 30m
Theory classes: 2h 30m

GRADING SYSTEM

Final examination: 60%
Partial (Control) examination: 40%

BIBLIOGRAPHY

Basic:
- Richards, M.A.; Scheer, J.A.; Hoolm, W.A. (eds.). Principles of modern radar: vol. 1: basic principles. Raleigh: Scitech Publishing, 2010. ISBN 978-1-891121-52-4.
- Skolnik, M.I. Introduction to radar systems. 3rd ed. Boston (Mass.): McGraw-Hill, 2001. ISBN 0072909803.

Complementary:
- Eaves, J.L.; Reedy, E.K. Principles of modern radar. New York: Chapman & Hall : ITP International Thomson Publishing, 1987. ISBN 9781461291701.
- Levanon, N. Radar principles. New York: John Wiley and Sons, 1988. ISBN 0471858811.