Last update: 30-10-2018

300244 - MGTA - Models for Air Traffic Management

Coordinating unit: 300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering

Teaching unit: 748 - FIS - Department of Physics
749 - MAT - Department of Mathematics

Academic year: 2018

Degree: BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERINGS/BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING - NETWORK ENGINEERING (AGRUPACIÓ DE SIMULTANEÏTAT) (Syllabus 2015). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN TELECOMMUNICATIONS SYSTEMS ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)
BACHELOR'S DEGREE IN AEROSPACE SYSTEMS ENGINEERING/BACHELOR'S DEGREE IN NETWORK ENGINEERING (Syllabus 2015). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: English

Teaching staff

Coordinator: Definit a la infoweb de l'assignatura.

Others: Definit a la infoweb de l'assignatura.

Prior skills

. Fundamentals of current air transport system, air traffic structures and air traffic management:

Knowing the different phases of air transport management. Knowing today's algorithms used to adjust the demand to the capacity of the air transport network. Understanding the links between airspace management, air traffic flux management and air traffic control. Understanding the links between the airspace design, its capacity and the demand.

. Fundamentals of modular programming and mathematical programming:

Having the background to understand the principles of modular programming. Being able to program codes to solve simple problems, such as finding a component within a vector. Having previously programmed with high level programming languages such as Octave or Matlab

. Having a good knowledge of English and technical English

Requirements

Prerequisites:
. Having taken Air Transport Structures (2A)
. Having taken Programming I (1B)
. Having taken Programming II (2A)

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Teaching methodology

The course combines the following teaching methodologies:
- Theory classes.
- Autonomous learning: students will study using self-learning material.
- Cooperative learning: students will form small group (2-4 people) to fulfill some of the activities of the course.
- Project based learning: students will build a small team project (3-4 people).

Directed learning hours will consist in exercises and practical examples, after the theory classes in which the professor exposes the content of the subject. With the directed learning hours, the students will be motivated to participate actively in their education and to complete the knowledge acquired during theory classes. Lab hours will take place in groups of 2-3 students. Labs are designed such that they strengthen theoretical concepts, allow developing basic experimental knowledge, and strengthen team work.

Usually, after each session, homework will be given to the students, such as proposed specialized readings, and individual or group exercises.

Learning objectives of the subject

In this course, the new air traffic management systems, being developed in Europe and in the USA (SESAR and NextGen), will be presented. The subject foreseen in the Air Transport Structures course will be detailed. Optimization techniques and operative research techniques used in the airspace management will be proposed, as well as modeling and airspace optimization techniques.

At the end of the course, the student will:
. know the main characteristics of the European and North-American air traffic management projects,
. know the main mathematical optimization techniques used in airspace optimization,
. be able to model airspace problems using mathematical techniques, and choose the most adequate optimization technique,
. know research techniques related to air traffic management and air traffic control.

Study load

Total learning time: 150h	Hours large group:	12h	8.00%
	Hours small group:	24h	16.00%
	Guided activities:	30h	20.00%
	Self study:	84h	56.00%

Content

Optimization techniques and Operational Research	Learning time: 24h Theory classes: 2h Laboratory classes: 4h Guided activities: 4h Self study : 14h

Description:
Integer programming (Simplex algorithm, Linear programming)
Metaheuristic optimization (e. g. Genetic Algorithm, Ant colony algorithm)

Airspace Modelling	Learning time: 75h Theory classes: 5h Laboratory classes: 14h Guided activities: 14h Self study : 42h

Description:
. Optimization techniques and airspace modeling techniques
. Runway capacity, sequencing and merging
. 2D and 3D sectorizations
. Ground holding problem
. Airspace Flow Programs
. Traffic assigment problem

Air Traffic Control Automatization	Learning time: 9h Theory classes: 2h Laboratory classes: 2h Self study : 5h

Description:
. Air traffic complexity metrics
. ATC advanced functionalities (AMAN, DMAN, SMAN, CNS, safety nets)
. Conflict detection and conflict resolution techniques

Research in ATM/ATC	Learning time: 18h Theory classes: 1h Laboratory classes: 2h Guided activities: 6h Self study : 9h

Description:
. Analysis of research papers from Air Traffic Management and Air Traffic Control.
. Advanced techniques of management and automatization of Air Traffic Control.

ATM - SESAR/NextGen	Learning time: 24h Theory classes: 2h Laboratory classes: 2h Guided activities: 6h Self study : 14h

Description:
. Introduction to SESAR and NextGen projects
. Differences and specificities of the USA air traffic management

Bibliography

Basic:

Bianco, Lucio; Odoni, Amedeo R. New concepts and methods in air traffic management. Berlin ; New York: Springer, 2001. ISBN 3540416374.

Others resources:

Excel, MatLab/Octave, PowerPoint