Universitat Autònoma de Barcelona

2020/2021

Airport Resource Management

Code: 42873
ECTS Credits: 6

Degree	Type	Year	Semester
4313785 Aeronautical Management	OB	0	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: spanish (spa)

External teachers

Angel Alejandro Juan Perez

Prerequisites

Subjects M4, M5 and M6

Objectives and Contextualisation

Resources Management in a dynamic context characterized by constant changes due to both the uncertainty in the duration of activities and the constant disturbances that flows among processes is considered as a complex system due to the interdependencies between activities and resources, which affect the performance of the system as a whole.

A holistic approach that allows obtaining a better knowledge of the different emerging dynamics that usually appear in systems with a high degree of interdependencies, is essential to be able to improve the performance of the system and design mitigation mechanisms for the propagation of disturbances between the different processes.

The main objective of this module is to consolidate the academic concepts introduced in the M4 module of decision making in the resolution of complex problems described in modules M5 and M6. Students will be introduced to a causal approach in the development of simulation models, which will allow them to acquire a better knowledge of the effects of uncertainties on the overall behavior of the system. The causal models will be formalized through Colored Petri Nets to describe the cause-effect relationships between the activities and the airport resources. To achieve the present training objective, the following sub-objectives are considered:

Introduction to holistic analysis, as opposed to a reductionist approach, in which the airport system is modeled as a set of resources that interact in a dynamic context.
Identify the interactions between the resources and the activities to be carried out, which determine the behavior of the airport system.
Identify emerging dynamics as the result of cause-effect relationships.
Development of simulation models considering the variables of influence.

Competences

- Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
- Execute a simulation project to improve performance indicators for airport processes.
- Seek out new areas to open up within the field.
- Solve complex problems by adopting a rigorous, efficient approach.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Learning Outcomes

1. Analyse relations of dependency between processes that affect overall performance.
2. Communicate and justify conclusions clearly and unambiguously to both specialised and non-specialised audiences.
3. Design mechanisms to mitigate interferences to performance parameters and quality factors.
4. Design techniques for the efficient management of airport resources, taking previous findings into account.
5. Develop causal models to calculate performance parameters.
6. Seek out new areas to open up within the field.
7. Solve complex problems by adopting a rigorous, efficient approach.
8. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
9. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.

Content

Theory

GRA.T.1: Introduction to Resource Management in a dynamic context

Flexibility as a source of complex problems
Performance Indicators

GRA.T.2: Modeling of Discrete Event Systems

Definition and Concepts.
Petri Nets: Specification of logical relationships.
Colored Petri Nets: Information flow specification.

GRA.T.3: State Space

The reachability tree
Analysis of causal relationships
Mechanisms of mitigation of undesirable dynamics.

GRA.T.4: Causal Simulation Models

Test-and-error approach
Validation and Verification of Simulation Models.

GRA.T.5: Experimental approach to minimize operations without added value:

Evaluation of bottlenecks
Policies based on Little's Law
Algorithms of minimization of variance

PROBLEMS

GRA.P.1 Examples:

Simulation of passenger flow throught the screening process
Simulation of arrivals and departures in a shared mode runway
Gate assignment model

GRA.P.2 Petri Nets Exercises

GRA.P.3 Colored Petri Nets Exercises

GRA.P.4 Exercises in CPN-Tools

GRA.P.5 State Space Exercises

Lab Exercises

GRA.L.4 Introduction to CAST

GRA.L.5 Terminal model in CAST

GRA.L.6 Simulation Project

Methodology

The course is organized through master classes. The learning process will combine the following activities:

Theoretical lectures
Problem Sessions
Practical exercises: simulation laboratory, group work and oral presentations.
Autonomous work.

Practical case studies and simulation tools are used to improve the experience of students in the management of airport resources.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Master Lectures	20	0.8	1, 7, 5, 3, 9
Problem Exercises	10	0.4	7, 5, 4, 8
Type: Supervised			
Lab Exercises	15	0.6	7, 5, 6, 8, 2
Type: Autonomous			
Home Work	34	1.36	5, 3, 4, 9
Modeling	70	2.8	7, 5, 6, 8

Assessment

The final score will be obtained from the evaluation of different activities:

Exercises in Petri Nets.
Analysis of the State Space of a case study and oral presentation.
Simulation models and documentation of different case studies.

In order to obtain the final mark , the grade of each of them must be above 5 points (out of 10). All activities based on the report must be submitted within the due dates indicated by the teacher. If an activity based on the report is missed, the student will be asked to re-submit their report according to the corrections / indications provided by the teacher.

If the oral presentation is not approved, the student will have the opportunity to work in a second case study for a short period of time, which will be communicated to the student in advance.

The student will be allowed for examination whenever they have submitted to a set of activities that represent at least two thirds of the total grade of the subject. The weights of each evaluation activity are given in the following table

Important note: In order to have the right to be evaluated in this module, the minimum percentages of attendance to class indicated below must be accredited:

- In the blended modality: 75%

- In virtual mode: 50%

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Petri Net Models	20%	0	0	1, 7, 5, 3, 4, 8
Simulation Models	30%	0	0	1, 7, 4, 6, 2, 9
State Space and Defense	50%	1	0.04	1, 5, 3, 4, 8, 2

Bibliography

N.Viswanadham,Y. Narahari. Performance Modeling of Automated Manufacturing Systems. Prentice Hall. 1992.

Merkuryev, Merkureva, Guasch, Piera: Simulation-Based Case Studies in Logistics: Education and Applied Research. Springer London. 2009.

Guasch, Piera, Casanova, Figueras: Modelado y Simulación : Aplicación a procesos logísticos de fabricación y servicios. Ed. UPC. 2002.

Lecturas Adicionales

Javier Campos, Carla Seatzu, Xiaolan Xi. Formal Methods in Manufacturing. CRC Press 2014.

Taylor. Agent Based Modeling and Simulation. Palgrave Macmillan. 2014

N. Gilbert . Simulation for the Social Scientist.. Open University Press.