UAB
Universitat Autònoma de Barcelona

2021/2022

Maintenance, Maintainability and Reliability

Code: 101740
ECTS Credits: 6

Degree	Type	Year	Semester
2501233 Aeronautical Management	OT	4	0

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: catalan (cat)

Some groups entirely in English: No

Some groups entirely in Catalan: No

Some groups entirely in Spanish: No

Prerequisites

Basic statistical knowledge is recommended as well as the ability to read (and understand) technical texts in English.

Objectives and Contextualisation

It is widely known by professionals in the industrial sector that the incorporation of Reliability, Availability and Maintainability characteristics in the design stage of a system and its components is the best way to ensure that this system has an adequate long-term cost-effectiveness ratio. Under this motivation, this subject aims to study the main theoretical foundations associated with the concepts of reliability, availability and maintainability, and their relationship with the effectiveness of the systems. Additionally, its application will be applied to practical cases.

Competences

- Apply specific software for solving problems in the aeronautical sector.
- Communication.
- Identify, develop and maintain the necessary resources to meet the tactical and operative needs inherent to air transport activities.
- Personal attitude.
- Personal work habits.
- Thinking skills.
- Use knowledge of the fundamental principles of mathematics, economics, information technologies and psychology of organisations and work to understand, develop and evaluate the management processes of the different systems in the aeronautical sector.
- Work in teams.

Learning Outcomes

1. Accept and respect the role of the various team members and the different levels of dependence within the team.

2. Carry out system-reliability studies.
3. Communicate knowledge and findings efficiently, both orally and in writing, both in professional situations and with a non-expert audience.
4. Critically assess the work done.
5. Develop critical thought and reasoning.
6. Develop curiosity and creativity.
7. Develop independent learning strategies.
8. Develop scientific thinking skills.
9. Develop systemic thinking.
10. Develop the ability to analyse, synthesise and plan ahead.
11. Draw up a maintenance plan for a system.
12. Generate innovative and competitive proposals in professional practice.
13. Identify the principles behind system reliability and maintainability.
14. Identify, manage and resolve conflicts.
15. Make decisions.
16. Make efficient use of ICT in communicating ideas and results.
17. Manage a system's maintenance operations.
18. Manage information, critically appraising innovations in the field, and analyse future trends.
19. Manage time and available resources. Work in an organised manner.
20. Prevent and solve problems.
21. Use specific software for maintenance management.
22. Work cooperatively.
23. Work independently.

Content

PART I: STATISTICAL BASIS

1. Fundamental concepts
1.1. Time of life
1.2. Reliability function
1.3. Average life
1.4. Failure rate
1.5. Relationship between concepts
1.6. Censored observations

2. HABITUAL STATISTICAL DISTRIBUTIONS
2.1. Exponential distribution
2.2. Weibull distribution
2.3. Distributions Gama and k-Erlang
2.4. Log-normal distribution

3. GRAPHICAL DATA IDENTIFICATION AND DESCRIPTION
3.1. Probability graphs
3.2. Graphical description of data

PART II: MMF IN COMPONENTS

4. PARAMETRIC DATA ANALYSIS
4.1. Estimation of parameters in complete observations
4.2. Estimation of parameters in censored observations

5. NON-PARAMETRIC DATA ANALYSIS
5.1. Estimation of reliability in complete observations
5.2. Estimation of reliability in censored observations

6. SOFTWARE AND ONLINE RESOURCES
6.1. Software
6.2. Online resources

PART III: MMF IN SYSTEMS

7. SIMULATION OF DISCRETE SYSTEMS
7.1. Basic definitions
7.2. Advantages of simulation
7.3. Phases of a simulation
7.4. Monte Carlo simulation
7.5. Simulation of Discrete Events
7.6. Key aspects in a simulation
7.7. Verification, validation and credibility
7.8. Simulation software
7.9. Practical examples of systems simulation

8. RELIABILITY AND AVAILABILITY OF SYSTEMS (I)
8.1. Basic systems structures
8.2. Consistent systems
8.3. Roads and cuts
8.4. Importance of the components
8.5. Systems decomposition

9. RELIABILITY AND AVAILABILITY OF SYSTEMS (II)
9.1. Introduction of the time variable
9.2. Assumption of independence
9.3. Availability in basic structures
9.4. Inclusion-exclusion principle
9.5. Availability versus reliability
9.6. Two alternative approaches
9.7. Reliability of basic structures
9.8. Reliability of systems through simulation
9.9. Basic concepts of availability
9.10. Availability of systems through simulation

10. SOFTWARE AND RESOURCES ONLINE
10.1. Software
10.2. Online resources

PART IV: RAM OPERATIONAL MANAGEMENT

11. APPLICATIONS OF RAM SIMULATION
11.1. Reliability of complex systems through simulation
11.2. Availability of complex systems through simulation
11.3. Application examples in real systems

12. REVIEW OF SCIENTIFIC ARTICLES ON RAM MANAGEMENT
12.1. Articles on RAM management in the industry
12.2. Articles on RAM management in services

Methodology

Teaching will be offered on campus or in an on-campus and remote hybrid format depending on the number of students per group and the size of the rooms at 50% capacity.

The methodology of the subject is based on a combination of theoretical and practical classes. During the theoretical classes, the professor will present the fundamental concepts of the assignment, whereas, in the practical classes, students will be those who, working individually or in small groups, will carry out the activities and exercises proposed during the course.

Will be encouraged to work in collaborative groups, the use of ICTs, and also the use of specialized software (eg: R, MINITAB, Excel, SREMS, SAEDES, etc.).

The proposed teaching methodology may undergo some modifications according to the restrictions imposed by the health authorities on on-campus courses.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical sessions (Classroom & Labs)	24	0.96	4, 8, 9, 10, 6, 5, 11, 2, 12, 17, 18, 13, 14, 15, 20, 22, 21
Theoretical sessions	26	1.04	3, 8, 9, 10, 6, 5, 11, 2, 16, 17, 18, 13, 21
Type: Supervised			
Tutorship	18	0.72	7, 10, 6, 5, 11, 2, 12, 17, 18, 13, 20, 23, 21
Type: Autonomous			
Study	80	3.2	1, 4, 3, 7, 11, 2, 17, 19, 13, 15, 20, 22, 23, 21

Assessment

The proposed evaluation activities may undergo some changes according to the restrictions imposed by the health authorities on on-campus courses.

See description in Spanish or Catalan

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Lab practices	40%	0	0	1, 4, 3, 8, 9, 7, 10, 6, 5, 11, 2, 16, 17, 19, 13, 15, 20, 22, 23, 21
Problem-solving	30%	0	0	1, 4, 3, 8, 9, 7, 10, 6, 5, 11, 2, 16, 12, 17, 19, 18, 13, 14, 15, 20, 22, 23, 21
Theoretical exams	30%	2	0.08	4, 3, 8, 9, 7, 10, 6, 5, 11, 2, 12, 17, 19, 18, 13, 15, 20, 23

Bibliography

- González Fernández, Francisco Javier. Teoría y Práctica del Mantenimiento Industrial Avanzado. FC (Fundación Confemetal) Editorial, Madrid, 2003.
- Kister, Timothy C. & Hawkins, Bruce. Maintenance Planning and SchedulingHandbook.Elsevier, Oxford, 2006.
- Sols, Alberto. Fiabilidad, Mantenibilidad, Efectividad. Un Enfoque Sistémico. Publicaciones de la Universidad Pontificia Comillas, Madrid, 2000.

- Wolstenholme, Linda C. Reliability Modelling. A Statistical Approach. Chapman & Hall/CRC, 1999.

Software

Excel, Minitab (demo version), SREMS, SAEDES