Aerial navigation, air transport and airports

Academic Year: (2021 / 2022) **Review date: 10-06-2021**

Department assigned to the subject: Bioengineering and Aeroespace Engineering Department

Coordinating teacher: SOLER ARNEDO, MANUEL FERNANDO

Type: Compulsory ECTS Credits : 6.0

Year : 3 Semester : 2

REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

No prior knowledge is mandatory

OBJECTIVES

- Basic knowledge of air navigation concepts and procedures
- Basic knowledge of characteristics and operation of the different on-board navigation equipment.
- Basic knowledge of the different types of Navigation Aids, land-based and satellite-based, applicable to the various phases of flight.
- Basic understanding of aeronautical charts layout and their practical use.
- Basic knowledge of current and envisaged Air Traffic Management (ATM) and Air Traffic Control (ATC) systems.
- Basic understanding of Air Transport from different perspectives: economic, industrial and regulatory.
- Basic understanding of Airports configuration and layout.
- Basic understanding of Airports operation and management.

DESCRIPTION OF CONTENTS: PROGRAMME

Course Description

This course covers an introductory overview of the air transport industry and all those infrastructures that are needed to ensure aircraft fulfill safe and efficient operations. The course is divided in three blocks, namely: Air transportation, Air Navigation, and Airports.

Air transport plays an integral role in our way of life. Commercial airlines allow millions of people every year to attend business conventions or take vacations around the globe. Air transport represents also the fastest way to ship cargo over long distances. Air transport must be seen both as a business and as a technical and operational activity. Therefore, how an aircraft is operated and exploited, and what is the cost of operating and maintaining an aircraft are questions to be assessed. First, we need to understand the complex regulatory framework needed: ICAO and IATA will be studied. Second, within the air transport economy we need to consider aircraft performance and the particular characteristics of air transport. Thus, this block will briefly focus on the types of aircraft and manufactures, on the structure of costs of a typical airline, and on aviation¿s environmental fingerprint.

Air navigation is the process of steering an aircraft in flight from an initial to a final position, following a determined route, and fulfilling certain requirements of safety and efficiency. The navigation is performed by each aircraft independently, using diverse external sources of information and proper on-board equipment. CNS-ATM systems ensure that aircraft can circulate in the air in a safe and efficient manner. Therefore, in this block we analyze air navigation as a whole, including an introduction and historical perspective, the technical and operational framework, the so-called CNS-ATM concept. Finally, we analyze the project SESAR, giving an overview of future trends in the air navigation system.

Airports are a fundamental infrastructure to facilitate intermodal transportation and ensure that flights are performed in a safe way. First, we will focus on defining what airports are, providing a brief overview of their history, introducing their naming nomenclature, describing the variables that potentially affect the demand of air transportation, and thus the necessity of building an airport in a determined location, and finally giving a description of the master plan, the set of official documents for the design and construction of an airport. Then, the focus will be on providing a description of the configuration of a modern airport, including air-side and land-side elements. Finally, we will focus on analyzing airport operations.

Syllabus:

Block I: Air Transport

Topic 1: Introduction (Transport as whole, History, etc.)
Topic 2: Regulatory Framework (Air law, ICAO, Chicago Convention, Eurocontrol, IATA, etc.)
Topic 3: Agent Based modeling
3.1 Main Manufactures and aircraft models (Current state and future trends)
3.2 Airlines (deregulation trends, flag companies Vs Low cost, cost structure).
3.3 Other agents (Regulators, passsengers, interaction with airports and the air navigation system, etc.)
Topic 4: Aviation environmental fingerprint.

Block II: Air Navigation

Topic 5: Introduction (Definition, history, wind and meteo, types of flights, dead reckoning triangle, instruments, different speeds and formulas, etc.)
Topic 6: Communications, Navigation, and Surveillance.
6.1 Communication systems (Voice (HF, V/UHF, SATCOM) and Data (ACARS/FANS, VDL, CPDL) Communications Systems
6.2 Navigation systems (Inertial navigation and non autonomous navigation. Types of navaids: VOR, NDB, DME, ILS, GNSS-1 etc.)
6.3 Surveillance systems (RADAR, ADSB, etc.)
Topic 7: Air Traffic Management (ATM)
7.1 Air Space Management (ASM) (Cartography and route selection. Aeronautical Charts, Control volumes, Airspace Classification)
7.2 Air Traffic Flow and Capacity Management (ATFM)
7.3 Air Traffic Control (ATC)

Block III: Airports

Topic 8: Introduction (Definition, history, ICAO Anexo 14)
Topic 9: Planification (The master plan, Project)
Topic 10: Airport Infraestructure (Air-side and land-side; runway design; Terminal)
Topic 11: Airport operations (capacity and demand, delays, taxing, etc.)

LEARNING ACTIVITIES AND METHODOLOGY

- Theory sessions: interactive lectures on specific subjects related to air navigation, air transport and airport engineering.
- Practical sessions organized in groups: the class will be divided in groups and each group shall submit and present an original essay on a specific technical subject.
- Laboratories: Flight Simulator and Eurocontrol NEST
- Tutorials on demand previous e-mail notification and confirmation.

ASSESSMENT SYSTEM

- Cont. Evaluation: 75%
- End-of-Term exam (25%).

In order to pass the subject an overall mark of 5.0 out of maximum 10 (End-of-term + continuous evaluation) must be obtained. It is necessary to have a MINIMUM mark of 4.0 (out of maximum 10) in the end-of-term exam to pass the subject.

% end-of-term-examination:	25
% of continuous assessment (assigments, laboratory, practicals…):	75

BASIC BIBLIOGRAPHY

- Javier Lloret Introduction to Air Navigation: a technical and operational approach, ISBN 13: 978-1515302766, 2016, 2nd Ed.
- Peter Belobaba (Editor), Amedeo Odoni (Editor), Cynthia Barnhart (Editor) The Global Airline Industry, Wiley (ISBN 978-0470740774), 2009
- Richard de Neuville and Amadeo Odoni Airport Systems: Planning, Design and management, Aviation Week (ISBN 978-0-07-138477-3), 2003

ADDITIONAL BIBLIOGRAPHY

- I. Moir & A. Seabridge Military Avionics Systems, Wiley.
- Iván Tejada Anguiano Discover Airports, Colección ¿Descubrir¿ ¿ AENA.
- Benito, A. and Benito, E Descubrir el transporte aéreo y el medio ambiente, Serie Descubrir AENA., 2012
- Connor R. Walsh (ed.) Airline Industry: Strategies. Operations and Safety, NOVA Science Publishers, NY.
- Doganis The airline business, Psychology Press. , 2006
- F. J. Sáez Nieto & Y. Portillo Pérez Descubrir la Navegación Aerea, Colección Descubrir AENA.
- Horonjeff, R, et al. 5th edition Planning and Design of Airports, McGraw-Hill. , 2010
- J. Moya Honduvilla & M. A. Bernabé Poveda Descubrir la Cartografía Aeronáutica, Colección Descubrir AENA.
- Jorge Ontiveros Descubrir el Control Aereo , Colección Descubrir AENA.
- Luis Pérez, Rosa Arnaldo, Francisco Javier Saéz Nieto, Jorge Blanco, Victor Fernando Gómez Comendador Introducción al Sistema de Navegación Aérea, Garceta, 2013
- M. García Cruzado & B. S. Fairbanks Descubrir las Terminales Aeroportuarias, Colección Descubrir AENA.
- Mª Luz de Mateo García Descubrir la Navegación por Satélite, Colección Descubrir AENA.
- Nolan Fundamentals of air traffic control, Cengage Learning, 2010
- Sebastián Truyols Mateu y Francisco Alcubilla de la Fuente Transporte Aereo e Ingeniería Aeroportuaria, Delta.

BASIC ELECTRONIC RESOURCES

- Manuel Soler . Fundamentals of Aerospace Engineering OMM Campus Libros (ISBN 978-84-941606-3-9).: http://www.aerospaceengineering.es