

19388 - AW - Aviation Weather

Coordinating unit:	300 - EETAC - Castelldefels School of Telecommunications and Aerospace Engineering		
Teaching unit:	748 - FIS - Department of Physics		
Academic year:	2019		
Degree:	MASTER'S DEGREE IN AEROSPACE SCIENCE AND TECHNOLOGY (Syllabus 2015). (Teaching unit Optional)		
ECTS credits:	5	Teaching languages:	English

Teaching staff

Coordinator: Defined at the EETAC web page

Prior skills

To be able to operate with the concepts and laws of mechanics, thermodynamics and fluid mechanics.

To be able to operate in differential and integral calculus of vector fields.

Degree competences to which the subject contributes

Basic:

- CB6. (ENG) CB6 - Poseer y comprender conocimientos que aporten una base u oportunidad de ser originales en el desarrollo y/o aplicación de ideas, a menudo en un contexto de investigación.
- CB10. (ENG) CB10 - Que los estudiantes posean las habilidades de aprendizaje que les permitan continuar estudiando de un modo que habrá de ser en gran medida autodirigido o autónomo.
- CB7. (ENG) CB7 - Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios (o multidisciplinares) relacionados con su área de estudio.
- CB8. (ENG) CB8 - Que los estudiantes sean capaces de integrar conocimientos y enfrentarse a la complejidad de formular juicios a partir de una información que, siendo incompleta o limitada, incluya reflexiones sobre las responsabilidades sociales y éticas vinculadas a la aplicación de sus conocimientos y juicios.
- CB9. (ENG) CB9 - Que los estudiantes sepan comunicar sus conclusiones y los conocimientos y razones últimas que las sustentan a públicos especializados y no especializados de un modo claro y sin ambigüedades.

Specific:

CE4 MAST. (ENG) CE4: Aplicar el método científico para el estudio de la fenomenología particular del ambiente aeroespacial.

Transversal:

- CT5. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.
- CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

Teaching methodology

The contents of the course will be explained by theoretical lessons combining blackboard and slides and practical exercises

Learning objectives of the subject

At the end of the course, the student should be able to:

- Identify the different layers of the atmosphere and their main characteristics, the atmospheric composition and

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atmospheric phenomena in the troposphere.

- To define the fundamental physical variables: pressure, humidity, density, and temperature that drives atmospheric dynamics.
- Understand the thermal equilibrium, the radiative balance and stability of the atmosphere and apply them to flying conditions.
- Understand the origin of the horizontal and vertical movements of the air and how they affect to aviation.
- Understand the importance of water vapour in the atmosphere, its measurement, phase changes, and the formation of fog and clouds, and its influence on aviation.
- Understand the physics of clouds, and to be able to identify the 10 basic types, and associated weather phenomena.
- Know how precipitation occurs and how thunderstorms are formed and develop.
- Know the main hazards affecting aviation: CAT, icing, visibility, turbulence and how to forecast and avoid them.
- Understand the basics of general circulation and synoptic meteorology.
- Be able to understand and explain METARs, SIGMETs, significant weather charts.
- To understand the meteorological aspects of flight planning.

Study load

Total learning time: 125h	Hours large group:	45h	36.00%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	80h	64.00%

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Content

<p>Introduction</p>	<p>Learning time: 11h Theory classes: 3h Self study : 8h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Presentation and previous concepts. Meteorological scales. Importance of meteorology and climatology in aviation. - Definition, structure and composition of the atmosphere. - Main variables used to study the atmosphere: temperature, pressure, density, wind speed and direction. Units of measurement. - International Standard Atmosphere. The hydrostatic approximation. - Thermal equilibrium of the atmosphere. Black bodies: Wien, Stephan-Boltzman equations. Solar radiation. Solar constant. The greenhouse effect on Earth. 	
<p>Heat, stability and atmospheric dynamics</p>	<p>Learning time: 32h Theory classes: 10h Guided activities: 2h Self study : 20h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Stability of the atmosphere. Vertical movements. - Turbulence and winds in the atmosphere. Different types of wind depending on their horizontal scale: micro and mesoscale systems. - Altimeter settings on a plane or airport. Problems and relation with atmospheric pressure and temperature. - Main isobaric features: cyclones, anticyclone, ridge, trough - Wind shear. CATs 	
<p>Water in the atmosphere: humidity, clouds and precipitation</p>	<p>Learning time: 24h Theory classes: 6h Guided activities: 2h Self study : 16h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Water vapor in the atmosphere: pressure, condensation. Definitions of humidity. - Stability of the saturated air. Cloud formation. - Precipitation. Types of precipitation. Influence to the aircraft structure and performance. Icing. - Clouds classification: description, observation keys, and influence to the flight conditions. Cloud base and ceiling. Main weather phenomena associated to clouds. Condensation trails. - Thunderstorms. 	

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<p>General circulation and synoptic meteorology</p>	<p>Learning time: 18h Theory classes: 4h Guided activities: 2h Self study : 12h</p>
<p>Description:</p> <ul style="list-style-type: none"> - The Global Atmospheric Circulation. Distribution of Low and High atmospheric pressure on Earth. Cyclones and anticyclones. Major atmospheric circulation features: cells, belts, jet stream, waves of Rossby. - Geostrophic wind, gradient wind. - Air masses: origin and effect on the weather. - Fronts: types, associated precipitation and flight conditions. 	
<p>Meteorological information for aviation</p>	<p>Learning time: 19h Theory classes: 4h Guided activities: 3h Self study : 12h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Message and local reports: METAR, SPECI, TAF, SIGMET. - Significant weather maps. - Flight plans. - Weather forecast from numerical models. 	
<p>Meteorological hazards for aviation</p>	<p>Learning time: 21h Theory classes: 8h Guided activities: 1h Self study : 12h</p>
<p>Description:</p> <ul style="list-style-type: none"> - Visibility. Causes of atmospheric obscurity - Differentiate between the different types of visibility: horizontal visibility, slant visibility, prevailing visibility, RVR - Icing: Definition, formation and types of icing. - Significance of both hazards to aviation. - Turbulence at low levels. Definition. Orographic waves, rotors, wind shear. - CAT - Thunderstorms and severe weather. - Relation of meteorological hazards on fly phases. - Climate change and aviation: influence and impacts of climate change on aviation. 	

Qualification system

It will be defined in the EETAC web page

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Regulations for carrying out activities

All the activities to be evaluated are compulsory. Any exam or deliverable not presented on time will be evaluated with a zero mark. All the evaluations are individual

Bibliography

Basic:

Ahrens, C. Donald. *Meteorology today : an introduction to weather, climate, and the environment*. 8th. Pacific Grove, CA: Thomson/Brooks/Cole, 2007. ISBN 9780495011620.

Joint Aviation Authorities. *Meteorology : JAA ATPL training*. 2nd. Englewood: Jeppesen Sanderson, 2007. ISBN 0884874885.

Ledesma Jimeno, Manuel; Baleriola, Gabriel. *Meteorología aplicada a la aviación*. 12^a. Madrid: International Thomson Paraninfo, 2003. ISBN 8428328404.

Lankford, Terry T. *Aviation weather handbook*. New York: McGraw-Hill, 2001. ISBN 0071361030.

International Civil Aviation Organization. *Annexes to the Convention on International Civil Aviation* [Recurs electrònic]. Montreal: ICAO, [19??]-. ISBN 9291942405.

Complementary:

Stull, Roland B.; Ahrens, C. Donald. *Meteorology for scientists and engineers*. 2nd. Pacific Grove (Calif.): Brooks/Cole, 2000. ISBN 0534372147.

Vilà-Guerau de Arellano, Jordi. *Atmospheric boundary layer : integrating air chemistry and land interactions*. New York: Cambridge University Press, 2015. ISBN 9781107090941.