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

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

Academic year: 2018

Degree: MASTER'S DEGREE IN AEROSPACE SCIENCE AND TECHNOLOGY (Syllabus 2015). (Teaching unit Optional)
MASTER'S DEGREE IN AEROSPACE SCIENCE AND TECHNOLOGY (Syllabus 2009). (Teaching unit Optional)
DOCTORAL DEGREE IN AEROSPACE SCIENCE AND TECHNOLOGY (Syllabus 2007). (Teaching unit Optional)

ECTS credits: 5 Teaching languages: English

Teaching staff

Coordinator: Defined in the course webpage at the EETAC website.

Others: Defined in the course webpage at the EETAC website.

Prior skills

Operativity with the concepts, magnitudes and basic laws of Physics preferably with some knowledge of astrodynamics.
Operationality with algebraic and statistical data functions.
Ability to perform application programs in Matlab / Octave or C # language or similar.

Degree competences to which the subject contributes

Basic:

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.

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.

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.

Specific:

CE3 MAST. (ENG) CE3: Aplicar los métodos numéricos para ingeniería aeroespacial con especial énfasis en sus aplicaciones, y en especial en la dinámica de fluidos.

CE6 MAST. (ENG) CE6: Realizar, presentar y defender ante un tribunal universitario un ejercicio original realizado individualmente, consistente en un estudio de investigación en el campo de la Ingeniería Aeroespacial, en el que se sinteticen las competencias adquiridas en las enseñanzas, adoptando los avances y novedades en este campo y aportando ideas novedosas.

Generical:

CG2 MAST. (ENG) CG2: Identificar y aplicar los análisis teóricos, experimentales y numéricos fundamentales de uso actual en ingeniería aeroespacial.

Transversal:

CT3. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim

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of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
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 classes of the subject will be presential and expositive. Teaching material will be composed of PowerPoint presentations (which can be obtained from the first day) and links to pages and publications of special relevance. A devoted software, the GNSS-Lab Tool suite (gLAB), will be used in assisted laboratory group work supervised by the professors of the subject. Students will have to do a project of one selected topic of the subject, doing their exposition at the end of the course.

In particular, the formative activities applied during the course will be:
A01: Master classes (theory lectures)
A04: Assisted laboratory work (practical exercises)
A06: Project based learning

Learning objectives of the subject

Theoretical-practical study of the different navigation algorithms for Global Navigation Satellite System System (GNSS) to provide the student with a rigorous knowledge about the GNSS data processing. It is promoted the adquisition of the instrumental use of concepts and techniques in GNSS-based navigation.

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

Theory of Global Navigation Satellite System (GNSS) data processing

Learning time: 22h 30m
Theory classes: 22h 30m

Description:
Lecture 0: Introduction
Lecture 1: GNSS measurements and their combinations
Lecture 2: Satellite orbits and clocks computation accuracy
Lecture 3: Position estimation with pseudoranges
Lecture 4: Introduction to DGNSS
Lecture 5: Precise positioning with carrier phase (PPP)
Lecture 6: Differential positioning with code pseudoranges
Lecture 7: Carrier based differential positioning. Ambiguity resolution techniques

Laboratory exercises of Global Navigation Satellite System (GNSS) data processing

Learning time: 22h 30m
Theory classes: 22h 30m

Description:
Tutorial 0: UNIX enviroment, tools and skills. GNSS standard file formats
Tutorial 1: GNSS data processing laboratory exercises
Tutorial 2: Measurement analysis and error budget
Tutorial 3: Differential positioning with code measurements
Tutorial 4: Differential positioning and carrier ambiguity fixing
Tutorial 5: Analysis of propagation effects from GNSS observables

Qualification system

Defined in the course webpage at the EETAC website.

Regulations for carrying out activities

All the evaluation activities proposed are mandatory. An exam, deliverable or project not presented will be scored with a zero note. The examinations will be carried out individually, the project will be carried out in group and the delivery of problems can be both group and individual. The writing exam is open book. Students can bring any material to the assessment except internet/communication devices.

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Bibliography

Basic:

Sanz Subirana, Jaume; Juan Zornoza, J. Miguel; Hernández Pajares, Manuel. GNSS data processing. Noordwijk: ESA Publications Division, cop. 2013. ISBN 9789292218867.

Misra, Pratap; Enge, Per. Global positioning system : signals, measurements, and performance. 2nd ed. Lincoln: Ganga-Jamuna, cop. 2006. ISBN 0970954417.

Hofmann-Wellenhof, Bernhard; Lichtenegger, Herbert; Collins, James. Global positioning system : theory and practice. 4th ed. revised. Wien ; New York: Springer-Verlag, cop. 1997. ISBN 3211828397.

Complementary:

Hernández Pajares, Manuel; Juan Zornoza, J. Miguel; Sanz Subirana, Jaume. GPS data processing : code and phase : algorithms, techniques and recipes [on line]. 1st ed. (English). Barcelona: Centre de Publicacions del Campus Nord, UPC, DL 2005Available on: <http://gage.upc.edu/sites/default/files/TEACHING_MATERIAL/GPS_BOOK/ENGLISH/PDGPS/BOOK_PDGPS_gAGE_NAV_08.pdf>. ISBN 8493223050.

Others resources:

www.gage.upc.edu/tutorials

Audiovisual material

Course Slides (Theory & Laboratory)

Course Slides (theory & laboratory)

Computer material

GNSS-Lab Tool (gLAB)

An interactive educational multipurpose package to process and analyse GNSS data.