19396 - R - Radio Navigation

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.

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

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 acquisition of the instrumental use of concepts and techniques in GNSS-based navigation.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group: 45h</th>
<th>36.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group: 0h</td>
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<tr>
<td></td>
<td>Guided activities: 0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Self study: 80h</td>
<td>64.00%</td>
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Content

Theory of Global Navigation Satellite System (GNSS) data processing

| 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 |

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

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

| 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 |

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

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:


Complementary:


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.