Escola Superior d'Enginyeries Industrial, Aeroespacial i Audiovisual de Terrassa (**ESEIAAT**)

Global Navigation Satellite System

Subject Number: 205097

Dr. Adrià Rovira Garcia

website: **https://server.gage.upc.edu/ESEIAAT/**
user: **ESEIAAT**
Password: **upc2020**

Contact: **adria.rovira@upc.edu**
Campus Nord UPC Jordi Girona 1-3, 08034 Barcelona (Spain). **T: +34 93 4012531**

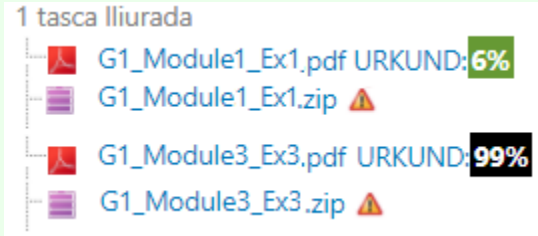
Subject Datasheet (i.e. Mission Requirements)

- **MASTER'S DEGREE IN:**
  - **AERONAUTICAL ENGINEERING (plan 2014)**
  - **SPACE AND AERONAUTICAL ENGINEERING (plan 2016)**

- **Credits: 3 ECTS**
- **Hours: 27 h (4 h / week) -> Effective: 22 h (4 h / week)**
- **Class: Mon (17h-19h) + Tue (17h-19h)**
- **Language: English, Spanish**

- **Evaluation:**
  - **60% Final Exam 28/03/2023 @ 17h**
  - **40% Laboratory Report**
    - **Groups of 3 people**

Atenea Submission



- **Contact: by email appointment**
  - **Write in the subject "ESEIAAT GNSS"**
  - **I am not a compiler: don't send me codes**

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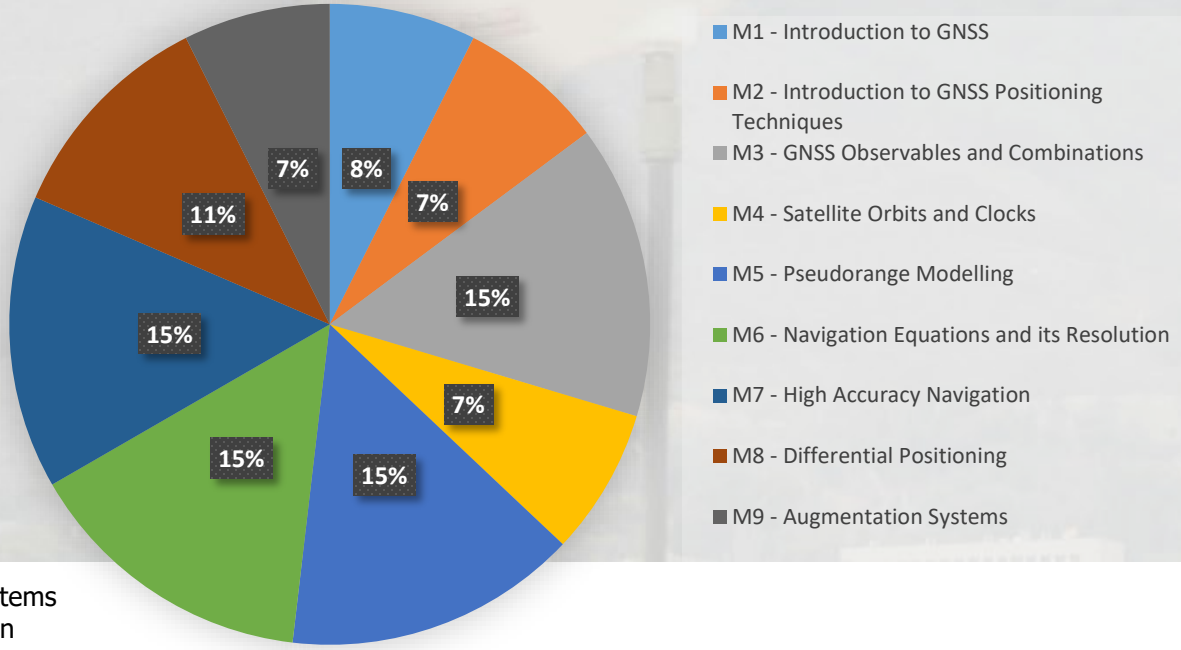
Course Overview *(i.e. Updated Mission Requirements)*

	Guia Docent		Reality	
Module	Time (h)	(%)	Time (h)	(%)
M1 - Introduction to GNSS	2	7.41	2	9.09
M2 - Introduction to GNSS Positioning Techniques	2	7.41	2	9.09
M3 - GNSS Observables and Combinations	4	14.81	3	13.64
M4 - Satellite Orbits and Clocks	2	7.41	2	9.09
M5 - Pseudorange Modelling	4	14.81	3	13.64
M6 - Navigation Equations and its Resolution	4	14.81	3	13.64
M7 - High Accuracy Navigation	4	14.81	2	9.09
M8 - Differential Positioning	3	11.11	3	13.64
M9 - Augmentation Systems	2	7.41	2	9.09
Total	**27**	**100.00**	**22**	**100.00**



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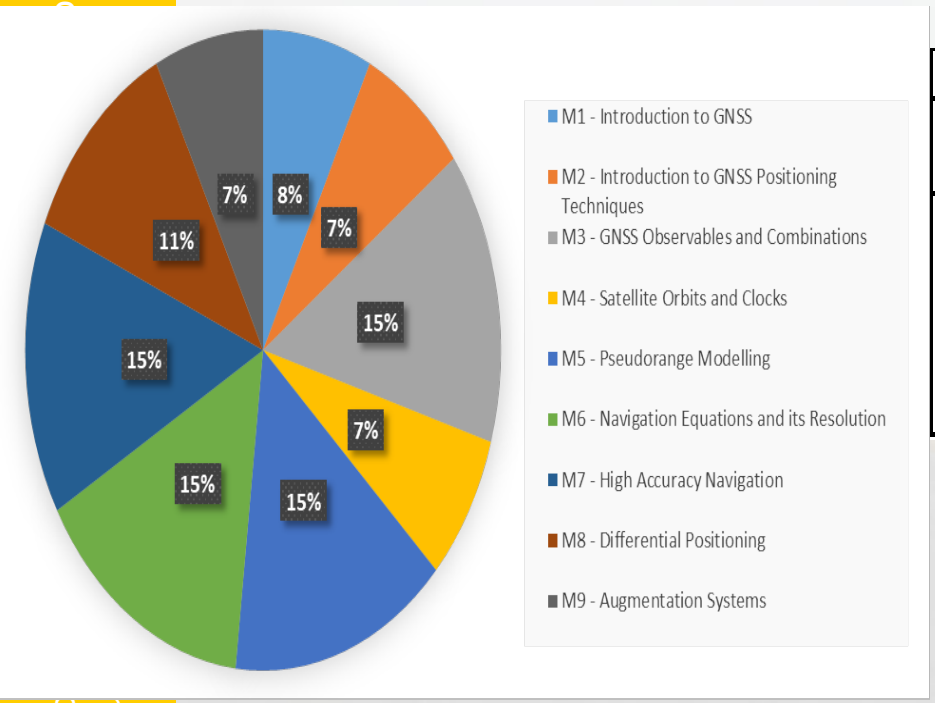
Course Schedule *(i.e. Mission Profile)*



	Mo	Tu	We	Th	Fr	Week
FEB	13	14	15	16	17	1
	01 - M10	02 - M20	22	23	24	2
MAR	03 - M30	04 - M40	1	2	3	3
	05 - M51	06 - M52	8	9	10	4
	07 - M61	08 - M62	15	16	17	5
	09 - M70	10 - M80	22	23	24	6
	11 - M90	EXAM 17h	29	31	1	7

ALSD #23. The schedule you develop will seem like a complete work of fiction until the time your customer fires you for not meeting it.
ALSD #27. (Varsi's Law) Schedules only move in one direction.

Laboratory Work (i.e. Mission Requirements)

- **Tutorials:**
  - **Tutorial 0. Introduction to gLAB tool suite**
  - **Tutorial 1. UNIX environment tools and skills**
  - **Tutorial 2. Measurements analysis and error budget**
  - **Tutorial 3. Model components analysis**
  - **Tutorial 4. Detailed code measurements modelling**
  - **Tutorial 5. Solving navigation equations**
- **Groups:**
  - **3 people**
- **Report:**
  - **Solve all questions posed in Tutorials 2, 3, 4, and 5**
  - **Maximum 100 pages**
- **Deadline:**
  - **@ Final Exam Date**
  - **Late submissions will be not collected**

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Bibliography

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

Hofmann-Wellenhof, B; Lichtenegger, H; Collins, J. ***Global positioning system: theory and practice****. 5th, rev. ed. Wien Springer, cop. 2001. ISBN 9783211835340.*

Misra, Pratap; Enge, Per. ***Global positioning system: signals, measurements and performance****. 2nd ed. Lincoln: Ganga-Jamuna, cop. 2006. ISBN 9780970954411.*

Xu, Guochang. ***GPS: theory, algorithms, and applications****. 2nd ed. Berlin. Springer, cop. 2007. ISBN 9783540727149.*

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GNSS_Data_processing_course1.png | gAGE : Advanced GNSS Research and Innovative Applications - Mozilla Firefox

File Edit View History Bookmarks Tools Help

GNSS_Data_processing_course1.png | gA...

www.gage.es/drupal6/content/gnssdataprocessingcourse1png

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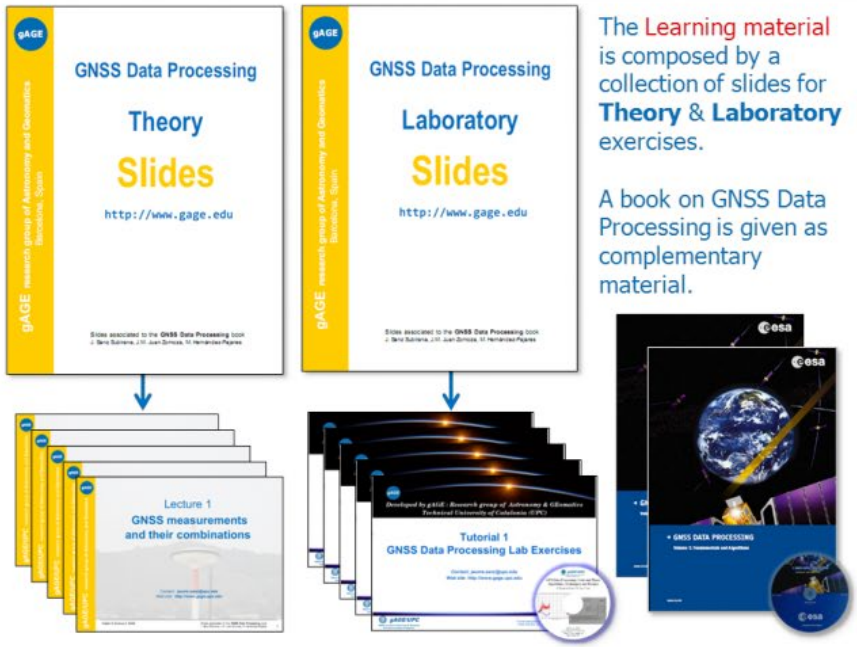
Tue, 09/03/2013 - 15:39 — jaume.sanz



The Learning material is composed by a collection of slides for **Theory** & **Laboratory** exercises.

A book on GNSS Data Processing is given as complementary material.

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About us

gAGE is a Consortium of the gAGE/UPC Research group of UPC and the Spin-off Company gAGE-NAV, S.L.

gAGE Brochure

Shortcuts
- gLAB Tool Suite
- gAGE Products
- Useful GNSS links
- GNSS Course and associated Tutorials
- MasterMast
- gAGE upload file facility

User login

Username: * jaume.sanz

Password: *

Log in

- Log in using OpenID
- Request new password

Who's online

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GNSS Data Processing, Vol. 1: Fundamentals and Algorithms.
GNSS Data Processing, Vol. 2: Laboratory exercises.

Akin's Laws of Spacecraft Design (ALSD)

1. Engineering is done with numbers. Analysis without numbers is only an opinion.

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13. Design is based on requirements. There's no justification for designing something one bit "better" than the requirements dictate.

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42. Space is a completely unforgiving environment. If you screw up the engineering, somebody dies (and there's no partial credit because most of the analysis was right...)

Source:
http://spacecraft.ssl.umd.edu/akins_laws.html

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Who Am I ?

Marie Skłodowska-Curie PostDoc Fellow - July 2018

Funded by European Commission (EC)

Joint Research Centre (JRC)

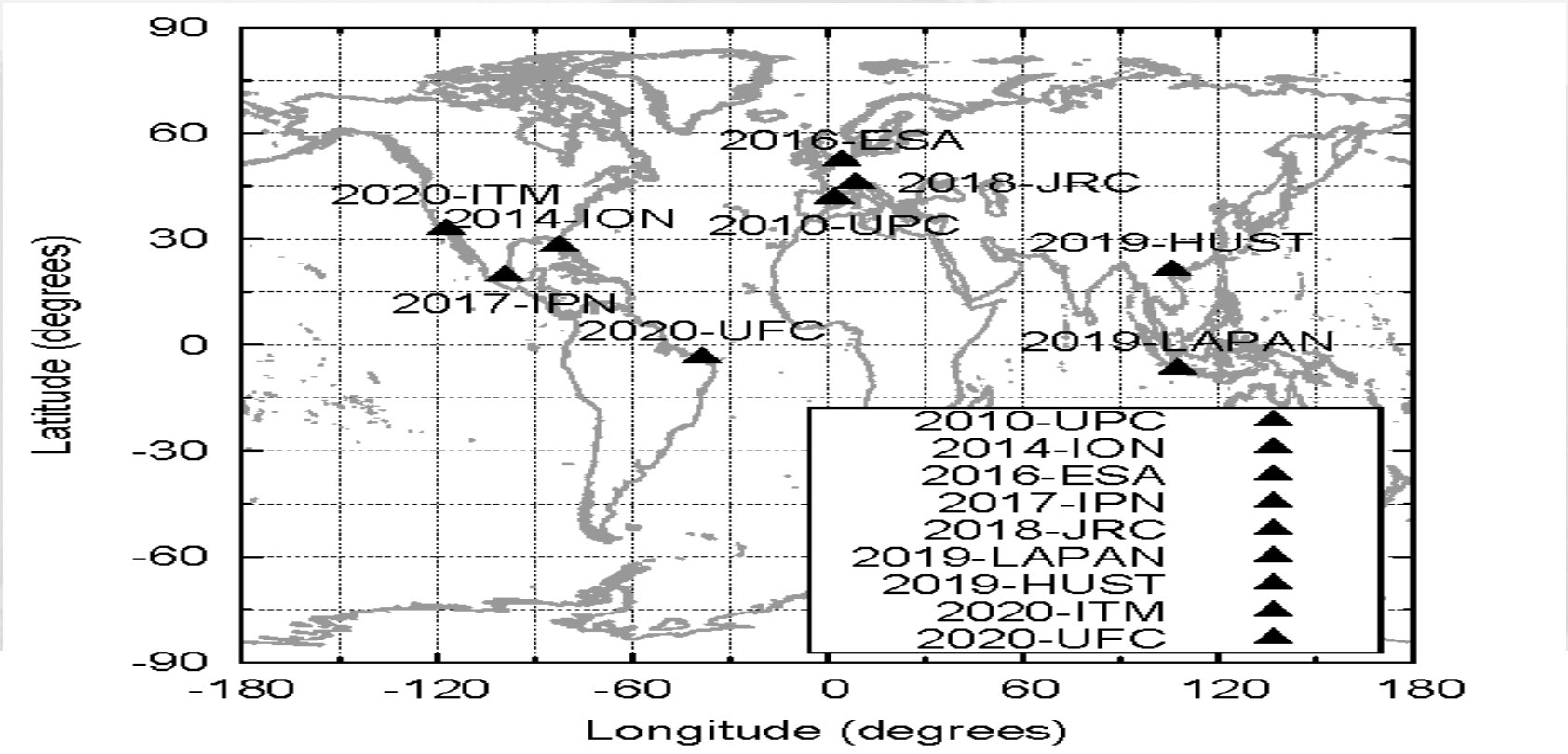
Hanoi University of Science and Technology (HUST)

PhD in Aerospace Science and Technology (60 ECTS) - Jan 2016

Funded by European Space Agency (ESA)

European Space Research and Technology Centre (ESTEC)

Aerospace Engineering (305 ECTS) - Mar 2010



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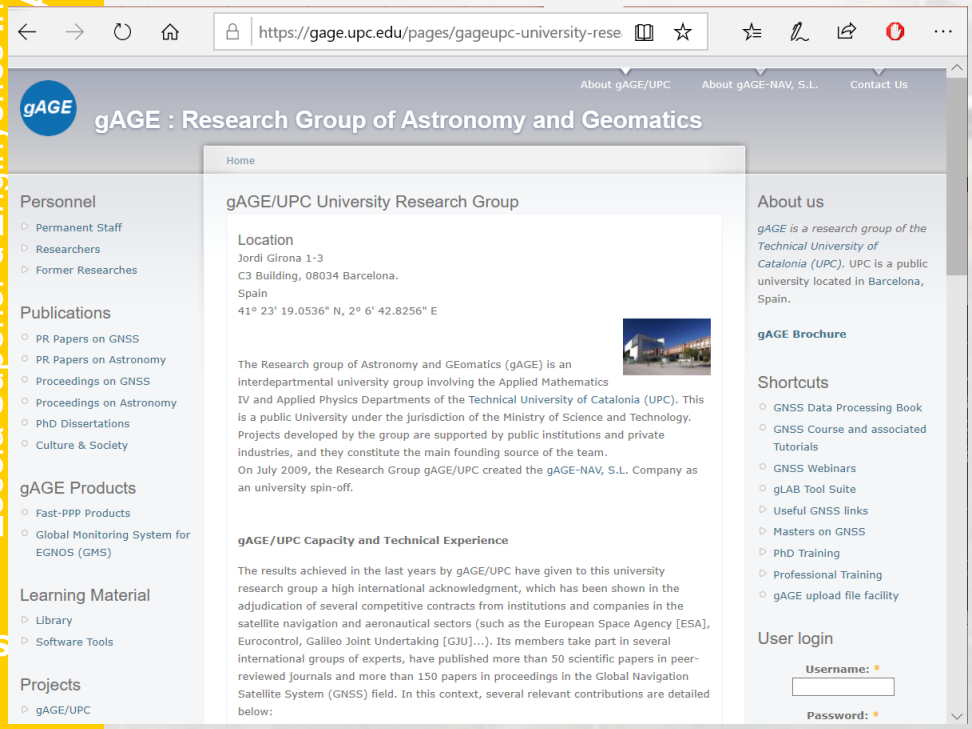
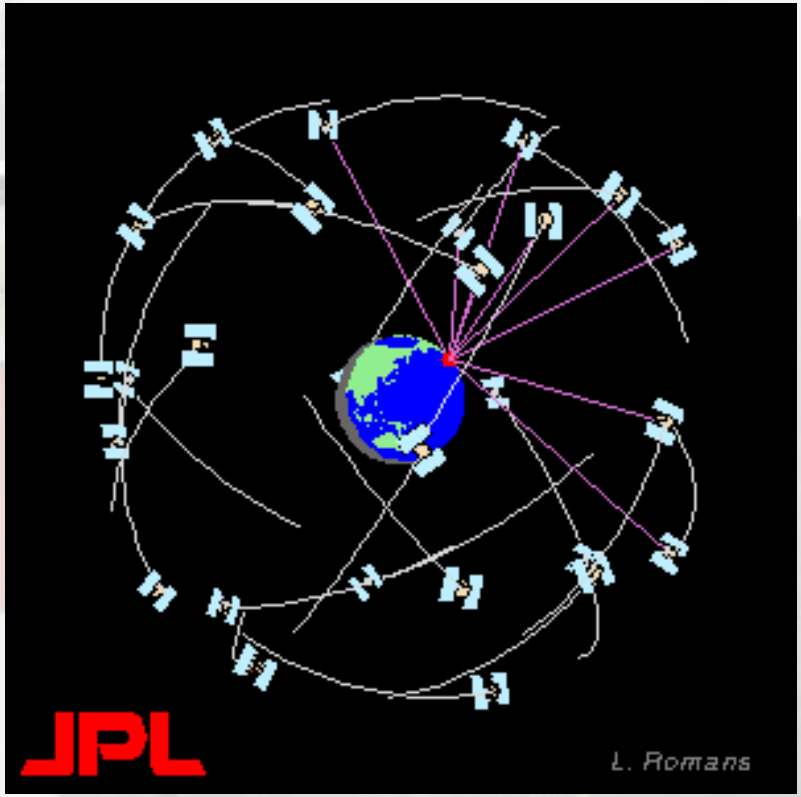
What I research ?

Research group of Astronomy and Geomatics (gAGE/UPC)

https://gage.upc.edu/

Global Navigation Satellite Systems (GNSS)
High Accuracy Navigation
Remote Sensing: Ionosphere





Space Tourism

Jet Propulsion Laboratory (JPL) in Pasadena, California:
https://www.jpl.nasa.gov/events/tours/

Johnson Space Center in Houston, Texas:
https://spacecenter.org/

Kennedy Space Center Visitor Complex, in Florida:
https://www.kennedyspacecenter.com/

National Air and Space Museum - Smithsonian Institution in Washington DC
https://airandspace.si.edu/

UNOOSA in Vienna Austria within the UN complex
http://www.unis.unvienna.org/unis/en/visitors_service/index.html

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Historical Note

a quart beer mug. At birth, Newton's neck was so weak a doctor at Woolsthorpe made him a bolster—a small neck brace—to support the weight of his head.

In his formative years, Isaac Newton was not an especially good student, but he had creative ideas and was very clever with his hands. He built a wooden doll house and a little windmill backed up by one mousepower. When the wind refused to blow, the mouse would run inside a rotating cylinder to provide the necessary motive power. The young Newton also constructed a kite that carried a lantern over the countryside at Woolsthorpe, thus, perhaps, creating one of the earliest UFOs ever observed. In these days, ordinary people were definitely not accustomed to seeing lights wobbling up and down as they traveled across the night sky.

Newton's Universal Law of Gravitation

In 1665, when Isaac Newton was an undergraduate at Cambridge University, the second Great Plague raged across the British Isles and Cambridge was shut down. Newton then returned to his boyhood home at Woolsthorpe. There, according to his own account, he noticed an apple falling from a tree. That simple observation caused him to challenge himself with a powerful question: "Why doesn't the moon also fall down toward the ground?"

Source: Logsdon T (1998) "Orbital Mechanics: Theory and Applications" 1st Edition, Wiley