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This course guide complements the information provided on the course in the MSc/MSS PROGRAM HANDBOOK (PHB). Students should refer to the PHB for information about Prerequisites, Learning objectives, Credits earned...

1. OVERVIEW

Module	Module 3: Space Studies Track System
Track	Track 1: Space Engineering and Applications
Course title	Course B: Space Applications: Earth Observation, Navigation and Telecommunication
Faculty Lead(s)	Dr. Moulay Anwar Sounny-Slitine
Start date	02 February 2026
End date	22 May 2026

2. GRADE DISTRIBUTION & ACADEMIC REQUIREMENTS

The final grade will be calculated as follows:

Assessment Formats	Weighting coefficient in the final grade, in percentage
☒ Exam	60%
☒ Workshop(s)	15%
☐ ☒ Group assignment(s)	15%
☒ ☐ Project-based learning (PBL)	
☐ Individual assignment(s)	
☐ Individual contribution	
☐ ☒ Quizzes (10%)	10%

Academic requirements: to pass the course, Students must obtain a final Course grade of 10/20 or above.

3. CONTENT OF THE COURSE

The information listed below describes the content of the course to the best of our knowledge. Unexpected circumstances may necessitate changes. Students will be kept informed throughout the program.

The Master's programs timetable with the schedule for these activities is available in the Google calendar.

a. Lectures / Case Study / Tutorial

- Cartography & GIS Fundamentals (Feb 5)
- Geographic Information Science (Feb 9)
- How to Make a Map / Geocoding (Feb 10)
- Georeferencing (Mar 5)
- Spatial Analysis (Mar 6)
- Image Processing & Interpretation (Mar 11)
- Hyperspectral Remote Sensing (Mar 11)
- Digital Image Processing (Mar 12)
- Image Classification (Mar 12)
- Change Detection (Mar 12)
- AI and ML in Earth Observation (Mar 12)
- Terrain Mapping & Radar Remote Sensing (Mar 19)
- Global Monitoring & Climate (Mar 20)
- UI / UX Design for EO Applications (Mar 20)
- Photogrammetry Fundamentals (May 5)
- Drone Data Fusion (May 5)

b. Workshops

Title	Preparatory work & deadline	Deliverables & deadlines	<i>If applicable, assessment format</i>	Weighing coef.
How to Make a Map (QGIS & ArcGIS)	Download and install QGIS. Familiarize with ArcGIS Online. Download: - NASA Systems Engineering Handbook from NASA website - SysML Modeling Tools on https://sysmltools.com/ Familiarize with MBSE tools and methodologies to design and analyze complex space systems.	Individually, students will complete a mapping assignment during the workshop.	The assignment will be graded.	15%
Geocoding Workshop	Review geocoding lecture slides. Download ESA Concurrent Design Facility (CDF) Handbook from ESA website Review NASA Concurrent Engineering Guidelines	Individually, students will complete a geocoding assignment.	The assignment will be graded.	10%
Georeferencing Lab	Review georeferencing lecture materials. - CAD	Individually, students will complete a georeferencing lab assignment.	The assignment will be graded.	10%
John Snow & Spatial Analytics	Read GIS eBook Introduction and Chapter 10 (Kernel Density Estimation). - -	Individually, students will complete the Broad Street Pump case study workshop using spatial epidemiology methods.	The assignment will be graded.	15%
Google Earth Engine Labs	Read RS eBook Chapters 9-10. Create a GEE account. - -	Individually, students will complete GEE lab exercises (data import, filtering, visualization, analysis, and exports).	The assignment will be graded.	15%
GEE Elevation Modeling	Complete GEE Intro Labs. - -	Individually, students will complete a DEM/elevation modeling lab.	The assignment will be graded.	15%
Drone Image Processing	Read RS eBook Chapters 16-18 (Photogrammetry, UAS/Drone RS, Point Clouds). - -	In groups, students will complete a photogrammetry/drone data processing lab using Pix4D/Agisoft workflows.	The assignment will be graded.	20%

c. Project-based learning (PBL)

Title	Preparatory work & deadline	Deliverables & deadlines	Assessment format
1. EO Web App Design: Designing Earth Observation Applications with TERRA	Familiarize with: EO data sources Web development basics UI/UX design principles. Review project briefing materials. - Design software (CAD) etc. - CAMEO - KiCAD - STK - Engineering simulation software - Programming software (Python, C, C++, C#)	In groups, students will design and develop an Earth Observation web application targeting SDGs. The project involves technical development, UI/UX design, and user testing. Final deliverable is a live demonstration and a recorded demo video screencast. Deadline: April 1, 2026 (Live Demo), April 10, 2026 (Final Video). They will then present their work on April 29. Students will also complete a peer-review evaluation.	The presentation (including live demo) and video report will be graded. Peer-review results will be incorporated in the group grade to make an individual grade. The results of the peer-review will be incorporated in the group grade to make an individual grade.

d. Professional visit(s)

Name of the organization	Location	Preparatory work & deadline	Logistics of the visit
SES Luxembourg Betzdorf, Luxembourg	Knowledge of Ground Stations. Business cards.	23 February 2026. Departure in a bus with the whole cohort at 6:00 from ISU parking. Return expected at 20H30 on ISU parking. Business cards	23 February 2026 Departure in a bus with the whole cohort at 6:00 from ISU parking. Return expected at 20H30 on ISU parking.

e. Project Timeline

- March 27, 10:00 - Project Briefing (requirements and group formation) - March 27, 11:00 - App Development (hands-on coding and data integration) - March 31, 10:00 - User Testing (peer feedback and prototype refinement) - April 1, 14:00 - Final Presentation (prerecorded demo and final report submission)

f. Quizzes

Five quizzes will be conducted via the course website during allocated class times. Topics cover all lecture and workshop material.

g. Exam

Date of the exam	22 May 2026 (Afternoon)
Length of the exam	120 minutes
Format of the exam	The exam will contain a series of questions to be answered with concise answers. No long essay is required. Question types are: demonstrate, interpret, organize, compare, examine, question, argue, appraise, critique, etc.
Examinable material	All lectures, all workshops, all group assignments.

Delivery mode of the exam	Students will use the EXAM.NET platform for their exam.
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4. ANNEXES

1. Sounny-Slitine, M.A. Remote Sensing & Google Earth Engine eBook. Available at: <https://sounny.github.io/rsgee>
2. Sounny-Slitine, M.A. GIS eBook. Available at: <https://sounny.github.io/gis>
3. Pelton, J.N. (2017). Handbook of satellite applications, volume 1 & 2. Springer.
4. Montenbruck, O. (2017). Springer handbook of global navigation satellite systems. Springer.
5. Maral, G., Bousquet, M. & Sun, Z. (2020). Satellite communications systems: Systems, techniques and technology. John Wiley.
6. Jade Morton, Y.T. (2021). Position, navigation, and timing technologies in the 21st century: Integrated satellite navigation. John Wiley.
7. Bhatta, B. (2021). Global navigation satellite systems: New technologies and applications (2nd ed.). CRC Press.