# Course guide

## 1. Introduction to Remote Sensing and Earth Observation Course guide

### Learning Objectives

At the end of this course, the students should be able to:

1. Understand and apply knowledge about electromagnetic (EM) radiation processes in the atmosphere (absorption, transmission and scattering) and Earth's surface (reflection, absorption, transmission and emission) to extract land cover information.
2. Translate geospatial questions into image characteristics and select the most suitable sensor data to extract information on the Earth's surface.
3. Apply techniques for optimum visualisation of remotely sensed imagery.
4. Choose and apply the appropriate geometric transformations of Earth Observation images to address specific spatial questions.
5. Apply appropriate radiometric image correction and enhancement operations to improve image analysis.
6. Apply pixel-based digital image classification to extract information on the Earth's surface.
7. Work independently in solving a problem, by integrating knowledge on the topics previously covered in the course.

### Course outline

The learning process is built around a series of topics linked to clearly described exercises. To achieve the learning objectives, the course is divided into seven (6) learning units:

1. Electromagnetic radiation
2. Sensors and image characteristics
3. Open-source software tutorial
4. Visualisation and radiometric operations
5. Geometric operations: Georeferencing and Geocoding
7. Digital image classification

Table 1 presents the link between the learning outcomes and learning units. A topic to familiarise students with open-source software is included. It aims to support the learning process, but it does not constitute a learning objective. (In principle, students can choose other software to process and analyse remotely sensed imagery).

Table 1. Learning outcomes in relation to the topics of the RS-EO course.

| | **Topics** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | |
| **Learning outcome 1**<br>Understand and apply knowledge about EM radiation processes to extract land cover information | X | | | | | | |
| **Learning outcome 2**<br>Translate geospatial questions into image characteristics and select the most suitable sensor data to extract information on the Earth's surface. | | | X | | | | |
| **Learning outcome 3**<br>Apply techniques for optimum visualisation of remotely sensed imagery. | | | | X | | | |

| | Topics | | | | | | |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | |
| **Learning outcome 4**<br>Choose and apply the appropriate geometric transformations of Earth Observation images to address specific spatial questions | | | | | X | | |
| **Learning outcome 5**<br>Apply appropriate radiometric image correction and enhancement operations to improve image analysis | | | | X | | | |
| **Learning outcome 6**<br>Apply pixel-based digital image classification to extract information on the Earth's surface | | | | | | X | |
| **Learning outcome 7**<br>Work independently in solving a problem, by integrating knowledge on the topics previously covered in the course | X | | X | X | X | X | X |

Students' time to complete the course (based on the proposal) is 6 hour per week for 26 weeks. It corresponds to the workload of approximately two weeks for full-time students, equivalent to 3 ECTS credits. Table 2 shows the time allocation per topic.

Table 2 Overview of the topics and the time needed for studying including the exercises and assessment

| **Topic** | **Content** | **Approximate time (days)**<br>**for full-time students** |
|---|---|---|
| 1 | EM radiation | 1 |
| 2 | Sensor and image characteristics | 0.5 |
| 3 | Open-source software tutorial | 1 |
| 4 | Visualisation and radiometric operations | 1.5 |
| 5 | Geometric operations: Georeferencing and Geocoding | 2 |
| | | |
| 6 | Digital image classification | 3 |
| | | |
| | Exam | 1 |
| | Total | 10 |

Each topic includes exercises for which we will provide model answers. A final assessment is based on the closed book exam. Exam questions will be in the form of multiple-choice answers. A minimum of 5.5/10 is considered as a passing mark in the course.

Table 3. Assessment matrix of the course

| **Test/ assignment** | **Formative/ summative assessment** | **Learning objective(s)** | **Required minimum mark** | **Weighting in the total mark (in %)** |
|---|---|---|---|---|
| Exercise in EM radiation | Summative | 1 | | |
| Exercise in Sensors and IC | Summative | 2 | | |

| | | | | |
|---|---|---|---|---|
| Exercise in visualisation | Summative | 3,5 | | |
| Exercise in georeferencing | Summative | 4 | | |
| | | | | |
| Assignment in DIC | Summative | 6 | | |
| | | | | |
| Exam | Formative | 1,2,3,4,5,6 | 5.5 | 100% |