Course guide
205072 - 205072 - Space Resources & Planetary Settlements

Last modified: 19/04/2023

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 758 - EPC - Department of Project and Construction Engineering.

Degree: MASTER'S DEGREE IN AERONAUTICAL ENGINEERING (Syllabus 2014). (Optional subject).
MASTER'S DEGREE IN SPACE AND AERONAUTICAL ENGINEERING (Syllabus 2016). (Optional subject).

Academic year: 2023 **ECTS Credits:** 3.0 **Languages:** English

LECTURER

Coordinating lecturer: IGNACIO CASANOVA HORMAECHEA

Others:

TEACHING METHODOLOGY

The course consists of lectures, personalized (and/or small group) tutorials, assignments, self-study and project preparation. During lectures, the instructor will offer theoretical concepts, and discuss reference materials. Homework will be assigned on a weekly basis in order to complement the content of lectures with practical exercises. Tutorials of small work groups will be carried out in order to monitor the progress of the elaboration of the final class project.

LEARNING OBJECTIVES OF THE SUBJECT

This course is designed as an advanced graduate study module for students with a strong background in the physical and/or engineering sciences, with the aim to provide an up-to-date perspective on current international efforts in the exploration and utilization of resources from space, and initiatives for the establishment of permanent (robotic and human) outposts on the surfaces of the Moon and Mars. Special attention will be put on developing criteria for a constructive and in-depth multidisciplinary analysis of reference mission definition. A complementary objective is to develop professional skills in the effective use of information and communication resources. The final class project will consist of a Case Study Analysis that will be presented in a variety of social network formats. Finally, guidelines and topic proposals will be provided to those students who express an interest in developing their Master's Thesis Project on any subject related to the contents of the course.

STUDY LOAD

Type	Hours	Percentage
Hours large group	27,0	36.00
Self study	48,0	64.00

Total learning time: 75 h

CONTENTS

Week 1: An overview of solar system exploration

Description:
Brief history of Solar System exploration. Missions to the terrestrial planets and asteroids. Missions to the outer planets and their satellites.

Related activities:
Elaboration of a short report on the main technologies (instrumentation) used for planetary exploration and critical assessment of their performance.

Full-or-part-time: 11h
Theory classes: 4h
Self study : 7h

Week 2: Resources from Near-Earth Space

Description:
What is a space resource?. The Moon: The Lunar regolith. Lunar oxygen production from crustal materials. Lunar ice. Near Earth Objects: review of asteroid compositions. Volatile products from carbonaceous asteroids. Mars and Beyond: Martian surface soils. Water on Mars. The Martian atmosphere. Martian satellites.

Related activities:
Report of categorization of different space resources according to their in-situ utilization potential

Full-or-part-time: 11h
Theory classes: 4h
Self study : 7h

Week 3: Resources at orbital platforms

Description:
The International Space Station. Water recovery systems. Atmosphere. The Micro-Ecological Life Support System Alternative (MELiSSA) programme

Related activities:
Visit to the MELiSSA Pilot Plant at the Universitat Autònoma de Barcelona. Attendance required.

Full-or-part-time: 11h
Theory classes: 4h
Self study : 7h

Week 4: Permanent planetary settlements: the Moon

Description:
Review of Lunar environmental conditions. Lunar construction. Science at and from the Moon. Sustainability and planetary protection issues. ESA's Moon Village project.

Related activities:
Short report on 1 concept (construction, science at/from, protection) and main requirements.

Full-or-part-time: 11h
Theory classes: 4h
Self study : 7h

Week 5: Permanent planetary settlements: Mars

Description:
Review of Martian environmental conditions. The Mars Surface Reference Mission: A Description of Human and Robotic Surface Activities. Precursor Measurements Necessary to Support Human Operations on the Martian Surface. Assessment of NASA's Mars Architecture 2007-2016. Human Exploration of Mars Design Reference Architecture 5.0.

Related activities:
Short report on pros/cons of robotic vs. human exploration/settlement of/at Mars

Full-or-part-time: 11h
Theory classes: 4h
Self study : 7h

Week 6: Case Study

Description:
Critical assessment of some specific proposal from industries and/or space agencies (instructor will provide necessary reference and data) or some advanced concept proposed by the students.

Related activities:
Generation of a report.

Full-or-part-time: 20h
Theory classes: 7h
Self study : 13h

GRADING SYSTEM

The course will be graded on the basis of:
- Homework assignments (5 x 10% each): 50%
- Final course project (case study report): 25%
- Quality/effectiveness of dissemination strategies (use social networks,...): 15%
- Participation in class: 10%