# Spacecraft Pre-design

**Academic Year: ( 2020 / 2021 )** **Review date: 08-07-2020**

**Department assigned to the subject: Department of Bioengineering and Aerospace Engineering**

**Coordinating teacher: MERINO MARTINEZ, MARIO**

**Type: Compulsory ECTS Credits : 3.0**

**Year : 1 Semester : 2**

## STUDENTS ARE EXPECTED TO HAVE COMPLETED

It is recommended to have passed (or be enrolled in) all courses related to spacecraft subsystems, systems engineering, and project management.

## COMPETENCES AND SKILLS THAT WILL BE ACQUIRED AND LEARNING RESULTS.

Basic competences

CB6 To possess and understand knowledge that provides a basis or opportunity to be original in the development and / or application of ideas, often in a research context

CB7 Students must know how to apply the knowledge acquired and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their area of study

CB8 Students must be able to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments

CB9 Students must know how to communicate their conclusions and the knowledge and ultimate reasons that sustain them to specialized and non-specialized audiences in a clear and unambiguous way

CB10 Students must have the learning skills allowing them to continue studying in a way that will be largely self-directed or autonomous.

General competences

CG2 Ability to make value judgments and prioritize in making conflicting decisions using systemic thinking.

CG3 Ability to analyze and correct the environmental and social impact of the technical solutions of any space system

CG4 Ability to work in multidisciplinary teams in a cooperative way to complete work tasks

CG5 Ability to handle the English, technical and colloquial language.

CG6 Ability to know adequately the business context of the professional sector, as well as to know and understand the applicable legislation in the exercise of the profession

Specific competences

CE1 Ability to conceive space products that respond to the needs of the stakeholders, defining functions, concepts and architecture, as well as developing project management.

CE2 Ability to plan and develop the design of space products in their different phases.

CE3 Ability to develop a complete system that meets the design specifications and the expectations of the interested parties. This includes the production of products; acquire, reuse or code products; integrate products in top-level assemblies; verify products against design specifications; validate the products against the expectations of the interested parties; and the transition of products to the next

level of the system.

CE4 Ability to manage technical activities during the life cycle of the project.

## DESCRIPTION OF CONTENTS: PROGRAMME

Synthesis course where student teams prepare a full pre-design of a space system to comply with a set of mission requirements set by the course staff. The knowledge and capabilities of other courses will be consolidated and put into practice here. Students will work in a team, each of them covering a specific role.

1. Mission requirements. Requirement and constraint flowdown
2. The space system predesign team and its roles
3. Preliminary design of space systems. Budgets and trade-offs
4. Preliminary design of space segment subsystems
5. Verification and validation
6. Technical report and presentation of results

## LEARNING ACTIVITIES AND METHODOLOGY

The course is composed of master classes (theory/problems/examples) and group work guided sessions.

The main activity in the course is the development of a space system predesign in a team. This will be carried out in the group work sessions and outside classes in the individual work time of the students. Group office hours can be requested by the students.

Student work will be presented orally and in written form in the last sessions of the course.

Students will defend their project and answer the comments of the professors in the oral exam of the course.

## ASSESSMENT SYSTEM

Continuous evaluation (100%)
- Oral presentation of the preliminary space system design, intermediate milestones
- Intermediate progress meetings
- Written report of the preliminary design, preliminary versions
- Attitude and participation in the course

Final exam (60%):
- Defense session of the project. Present answers to professor comments and revised version of project in oral session.

In order to pass the subject, two requirements need to be met:
1) to have a MINIMUM mark of 4.0/10 in the end-of-term oral exam;
2) to have a minimum overall mark of 5.0/10 (weighing 60% the end-of-term exam mark and 40% the mark of the continuous evaluation).

For the extraordinary evaluation, the grade will be the best grade of the two:
1) Grade of the extraordinary exam
2) Grade of the extraordinary exam (60%) plus continuous evaluation grade (40%).
It is still necessary to reach a MINIMUM of 4/10 in the exam and 5/10 in the global grade to pass the course.

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| **% end-of-term-examination:** | 60 |
| **% of continuous assessment (assigments, laboratory, practicals…):** | 40 |

## BASIC BIBLIOGRAPHY


- James R. Wertz (Editor), David F. Everett (Editor), Jeffery J. Puschell (Editor) Space Mission Engineering: The New SMAD, Microcosm Press, 2011
- NASA NASA SYSTEMS ENGINEERING HANDBOOK, NASA, N/A
- PMI A guide to the project management body of knowledge : (PMBOK guide), PMI, 2017
- Peter Fortescue, Graham Swinerd, John Stark Spacecraft systems engineering, John Wiley and Sons, 2011

## ADDITIONAL BIBLIOGRAPHY

- C.D. Brown Elements of Spacecraft Design, AIAA Education Series, 2002
- M.D. Griffin, J.R. French Space Vehicle Design, AIAA Education Series, 2004
- V.L. Pisacane Fundamentals of Space Systems Second Edition, Oxford University Press, 2005