CARLETON UNIVERSITY
DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

SPACECRAFT DESIGN I
AERO 3841 - Winter Term 2017

Course Description:
The main objective of this course is to introduce the fundamentals of the spacecraft design. The course will start with a brief overview of history of space exploration and review of solar system with an emphasis on several planetary missions. The typical spacecraft configurations for different space missions will be introduced. Then, the orbital mechanics fundamentals will be quickly reviewed. After introducing the basics concepts of the space environment, several spacecraft subsystems will be discussed in detail including communications, propulsion; attitude determination and control; structures; thermal, guidance and navigation, and power subsystems. Command and data handling subsystems and payload design will not be addressed in any detail. The course and associated hands-on labs are designed to provide a fundamental understanding of spacecraft bus and its several subsystems and interactions.

Course Learning Objectives:
1. Knowledge base of engineering fundamentals in spacecraft design (CEAB graduate attribute 1: Knowledge Base). See detailed topics under Course Outline below).
2. Problem analysis techniques for designing various spacecraft subsystems (CEAB graduate attribute 2: Problem Analysis).
3. Investigate the fundamentals of satellite assembly and testing and learn functionality of several subsystems using a desktop satellite. (CEAB graduate attribute 3: Investigation).
4. Preliminary design of a spacecraft mission with emphasis on the mission orbit and spacecraft subsystems (CEAB graduate attribute 4: Design).
5. Prepare lab reports and follow instructions provided by lab supervisors (CEAB graduate attribute 7: Communication).

Course Outline:
Part I
- Introduction: review of history of space exploration and solar system
- Spacecraft configuration
- Review of orbital mechanics
- Space environment and its effect on spacecraft design

Part II
- Spacecraft communication subsystem
- Spacecraft attitude determination and control subsystem
- Spacecraft guidance and navigation subsystem
- Spacecraft thermal subsystem
- Spacecraft structures and mechanisms
- Spacecraft propulsion subsystem
- Spacecraft power subsystem

General Information:
Instructor: Tarik Kaya
Office: ME3144; Phone: 5692; E-mail: tarik.kaya@carleton.ca
Office hours: Please send me an email to make an appointment

Course Grade Basis:

	Weight
Final	60%
Design Exercise	14%
Laboratories	20%
Assignments	6%

- The final examination grade should be *at least 40% to pass the course*.

- Participation in the group Design Exercise is mandatory. *Failure to take part in the Design Exercise and required report will lead to a grade of FND in the course.*

- Each student must complete successfully all of the assigned laboratories and submit the required log books. Labs will be held in ME2363. *Missing labs or failure to submit lab reports will lead to a grade of FND in the course.*

- Problems will be assigned through the course. You are strongly advised to study and attempt to answer the assigned problems. Only two (*randomly selected*) of the assigned problem sets will be graded.

References:
There is no compulsory text book for this course. The following books provide additional material to the Lecture Notes posted on the course web page.

1. Space Mission Analysis and Design, 3rd edition, James R. Wertz, and Wiley J. Larson, Microcosm Inc., 1999.
2. Spacecraft Systems Engineering, 3rd Edition, Peter W. Fortescue, John P. W. Stark, and Graham Swinerd, John Wiley&Sons, 2003.
3. Fundamentals of Space Systems, Second Edition, Vincent L. Pisacane, Oxford University Press, 2006.
4. Space Vehicle Design (AIAA Education Series), Michael D. Griffin, James R. French, and J. S. Przemieniecki, American Institute of Aeronautics and Astronautics, 1991.

Final Examination:
According the policy of the Faculty of Engineering and Design, the final examination is for evaluation purposes only and the marked final examination papers will not be returned to students.

Accommodation Statements:

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website: http://www2.carleton.ca/equity/

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website: http://www2.carleton.ca/equity/

Academic Accommodations for Students with Disabilities: The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). Requests made within two weeks will be reviewed on a case-by-case basis. After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam (if applicable).