EXPANDED COURSE DESCRIPTION

EARTH, SPACE SCIENCE AND ENGINEERING

Lassonde School of Engineering
Earth and Space Science and Engineering

LE / ESSE 2360 3.0 SECTION A
SPACE ENGINEERING
FALL 2017 / WINTER 2018

Last Modified Date: 09/07/2017

COURSE CALENDAR DESCRIPTION

The course provides an introduction and overview of space engineering. Space engineering activities are surveyed by segment and by sub-discipline and key concepts are introduced. The skillsets required of space engineers are investigated. Written and oral technical communication skills are emphasized. The topics discussed in the course provide the fundamentals of all aspects of space engineering as a profession and includes illustrative examples and discussions with practicing space engineers in the field. 3.0 contact hours per week; 1.0 laboratory hour per week. Prerequisites: ENG 1101 4.0 and ENG 1102 4.0 or permission of the instructor.

INSTRUCTOR(S)

<table>
<thead>
<tr>
<th>Name</th>
<th>Section / Format / Term</th>
<th>Contact Email</th>
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<tbody>
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ADDITIONAL INFORMATION

Topics and Concepts:

1. What is Space Engineering?
2. Types of missions – Communications, Earth observation, exploration/scientific, tech demo
3. Space segment/ground segment
4. Types of spacecraft – nano, micro, smallsat, medium, largesat
5. Launch Vehicles – structure, AOCS, engines payload. Types of launchers and engines/motors and fuels – solid, liquid, hybrid, specific impulse, the rocket equation, determining the number of stages.
6. Orbits – LEO, geosynchronous, geostationary, sun synchronous, half geostationary, Molniya
7. Orbital mechanics, orbital elements and orbit descriptions
8. Spacecraft subsystems – structure, power, communications, thermal, C&DH, ACS, orbit control
9. Basic rotational kinematics
10. Hardware: attitude and orbit sensors – magnetometers, star sensors, sun sensors, Earth sensors, IMUs, GPS; actuators: thrusters, magnetorquers, reaction wheels, control moment gyros, momentum wheels, bias momentum,
11. Planetary exploration, rovers, autonomous navigation,
12. Space robotics, SRMS, SSRMS, SPDM
13. Space environment: environmental forces and torques, aerodynamic, magnetic, gravitational, solar radiation,
14. Material effects of atomic oxygen and UV
15. Space disasters Ariane 5, Anik E1, E2, Radarsat 1 rescue, shuttle disasters.
16. Space program management

List of Learning Outcomes

1. Understand the basics of space missions, space vehicles and space hardware
2. Become familiar with the fundamentals of rocket propulsion, orbital mechanics, attitude kinematics
3. Develop technical writing capability

**Graded Assessment**

**Problem Sets:** 10%

**Midterm Exams:** Two, worth 20% each

**Lab Tests:** 5%

**Final Exam:** 45% of final grade

**Required Texts and Materials**

There is no text for this course. Notes will be presented in class and useful links provided.

**ACADEMIC INTEGRITY LINKS**

- Senate Policy on Academic Honesty - http://secretariat-policies.info.yorku.ca/policies/academic-honesty-senate-policy-on/
- Academic Integrity - http://lassonde.yorku.ca/academic-integrity

**STUDENT LINKS**

- Student Rights and Responsibilities - http://oscr.students.uit.yorku.ca/student-conduct
- Religious Observance - https://w2prod.sis.yorku.ca/Apps/WebObjects/cdm.woa/wa/regobs
- Counselling and Disability Services - http://cds.info.yorku.ca/

Many courses utilize Moodle, York University's course website system. If your course is using Moodle, click here to access it.

**Moodle @ York University**