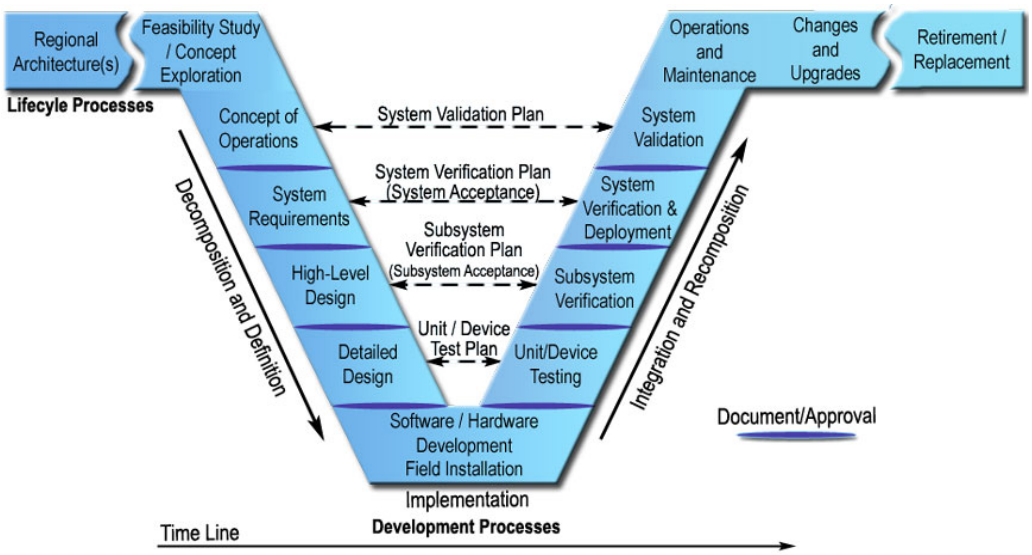
# AE110, Space Systems Engineering, Section 1, Fall 2016




(V-Model of Systems Engineering Process)

| | |
|---|---|
| **Instructor:** | Darryl LeVasseur<br>darryl.levasseur@sjsu.edu |
| **Office Hours:** | By Appointment |
| **Credit** | 3 Units |
| **Class Days/Time:** | Tuesdays & Thursdays 1:30 pm – 2:45 pm (13:30 – 14:45) |
| **Final Exam** | Friday, December 16 2016 |
| **Classroom:** | ENGR 164 |
| **Prerequisite** | Grade of "C-" or better in AE 165 |
| **Textbook** | *Systems Engineering: Design Principles and Models*<br>Author: Dahai Liu<br>ISBN13: 978-1466506831<br>ISBN10: 1466506830 |
| **References** | *NASA Systems Engineering Handbook*<br>NASA/SP-2007-6105 Rev1<br>http://ntrs.nasa.gov/search.jsp?R=20080008301<br>ISBN13: 978-0-16-079747-7 |
| **Course Description** | Introduction to design, analysis and operation of spacecraft power, communications, attitude determination/control, structures, propulsion, thermal management systems. Typical payload systems design and operation, including remote Earth sensors. System integration issues. Lab experiments and field trips. |

## Course Goals

1. Provide descriptions of the various elements comprising a space system.
2. Expose students to the challenge of integrating space system elements.
3. Provide an in-depth exposure to at least one spacecraft subsystem groups.
4. Educate students in the area of analysis and optimization of multidisciplinary space systems during the conceive and design phases.
5. Become familiar with the basic concepts of multi-objective optimization.

## Course Learning Objectives

Students completing AE110 should be able to:

| | |
|---|---|
| + | 1. Identify each element of a space system. |
| + | 2. Identify each subsystem of a spacecraft. |
| + | 3. Understand the effects of space environments on a spacecraft. |
| ++ | 4. Understand and implement requirement writing for systems. |
| ++ | 5. Understand systems contingency, margins, factors, and budgets. |
| ++ | 6. Apply model based system engineering techniques to design of product development |
| ++ | 7. Understand Manufacturers data sheets. |
| ++ | 8. Subdivide a complex system into smaller disciplinary models, manage their interfaces and reintegrate them into an overall system model. |
| ++ | 9. Perform a systems-level analysis of spacecraft subsystems including communication, power, thermal, attitude control, structures, guidance and navigation. |
| ++ | 10. Use traditional numerical optimization algorithms and interpret result. |
| +++ | 11. Conduct a risk assessment of a system and generate a risk matrix. |
| +++ | 12. Study a single spacecraft subsystem in detail within a team of 2-3 students and present their findings in class in a series of lectures. |
| +++ | 13. Rationalize and quantify a system architecture or product design problem by selecting appropriate objective functions, design parameters and constraints. |
| +++ | 14. Formulate a high-level spacecraft design given basic design parameters with imposed student generated requirements and constraints, involving trade-offs between competing subsystems demands. |

+: Skill level 1 or 2 in Bloom's Taxonomy
++: Skill level 3 or 4 in Bloom's Taxonomy
+++: Skill level 5 or 6 in Bloom's Taxonomy

## Course Relationship to BSAE Program Outcomes

| Learning Objectives | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 / 2 | | | | | ✓ / ✓ | | | | |
| 3 / 4 | | | | | ✓ / ✓ | | ✓ / | | |
| 5 / 6 | ✓ / | | | | | | | | |
| 7 / 8 | | | | / ✓ | | ✓ / | | ✓ / | |
| 9 / 10 | ✓ / ✓ | | | ✓ / | ✓ / | | | | ✓ / |
| 11 / 12 | / ✓ | | | / ✓ | / ✓ | ✓ / | ✓ / | | / ✓ |
| 13 / 14 | / ✓ | | ✓ / ✓ | / ✓ | ✓ / ✓ | / ✓ | / ✓ | / ✓ | / ✓ |

## *Approximate Weekly Schedule*

| Week | Topic |
|---|---|
| 1 | Introduction, Course Overview |
| 2 | Model Based Systems Engineering |
| 3 | Project Life Cycle, Scope, & Con ops |
| 4 | System Hierarchy, WBS |
| 5 | Requirements, Writing and Understanding |
| 6 | Space Vehicle Subsystems |
| 7 | Previous week Continued |
| 8 | Space Environments |
| 9 | Design, Trade Studies, Iterations, Technical reviews |
| 10 | Previous week Continued |
| 11 | Midterm |
| 12 | Risk, Optimization, Lessons Learned |
| 13 | Requirements Verification- Inspection, Demonstration, Test, Analysis |
| 14 | Management, Ethics |
| 15 | Miscellaneous Topics, Summary, Review |

**Grading:**

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| Homework/Quiz | 250 points |
| 1st Midterm | 300 points |
| Final Project | 350 points |

**Grading Scale:**

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|---|---|---|
| A+ | minimum score | 850 |
| A | minimum score | 800 |
| A- | minimum score | 750 |
| B+ | minimum score | 675 |
| B | minimum score | 625 |
| B- | minimum score | 600 |
| C+ | minimum score | 575 |
| C | minimum score | 525 |
| C- | minimum score | 500 |
| D | minimum score | 400 |
| F | below | 400 |

## Classroom Protocol

I expect all students to be respectful of others views and beliefs as this course shall involve assignments dependent on group participation. The use of cell phones is prohibited during class unless emergency in which please take conversation to the hall. Common courtesy and polite communication is expected within class.

## University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo