Course Syllabus

SYS 633 MISSION & SYSTEM DESIGN, VERIFICATION & VALIDATION

SSE

Spring 2024

Instructors: Dr. Peter Van Wirt, Dr. Jerry Sellers, Prof Pam Magee

Contact Info: See instructor bios

Virtual Office Hours: See announcements for scheduled office hours. Other hours by appointment.

Prerequisite(s): SYS 625, SYS 632

COURSE DESCRIPTION

This course provides a unique hands-on opportunity to apply key principles of space systems engineering. In Part 1 of the course, participants are given a set of customer expectations in the form of broad mission objectives/Request for Proposals (RFP). Using state-of-the-industry mission design and analysis tools, participants apply systems engineering processes to define top-level system requirements, design key elements and conclude with a Mission Concept Review. In Part 2 of the course, participants experience system realization processes first-hand with focus on verification & validation techniques. You will learn the importance of applying “test like you fly, fly like you test” principles for space through lecture and hands-on exercises.

STUDENT LEARNING OUTCOMES

This course will:

- Cultivate a better understanding of the overall space systems engineering process by integrating all elements of a successful mission
- Establish a process to refine requirements and define parameters to meet mission objectives at acceptable cost and risk
- Explain the end-to-end SE process and how it applies to system (and lower level) requirements definition, allocation, validation and verification.
- Describe the purpose and scope of key documents required in the validation and verification processes, and describe typical errors committed.
- Describe various methods of verification, when they are appropriate. and how they are used as part of a verification plan for a system of interest
- Determine appropriate circumstances and applicability of verification methods to prototype and proto-flight systems.
- Analyze representative verification plans, test sequences and activities for an example system of interest (spacecraft).
- Develop, evaluate and implement a master verification plan for a space system including hardware, software and associated ground support equipment (GSE).
- Apply processes and techniques in a hands-on workshop associated with a system of interest.
- Describe applicable NASA, ECSS, DoD and Industry Standards and lessons learned to support system verification decisions and activities.

COURSE FORMAT AND STRUCTURE

This course will be presented real-time through Zoom via Canvas.

Course Dates

PART 1: MISSION DESIGN

FIRST SESSION: January 19 – 20, 2024

SECOND SESSION: February 2 – 3, 2024

PART 2: Verification and Validation (V&V)

THIRD SESSION: February 16 – 17, 2024

FOURTH SESSION: March 1 – 2, 2024

Course Time

- **Pacific:** 7:30 am - 11:30 am
- **Mountain:** 8:30 am - 12:30 pm
- **Central:** 9:30 am - 1:30 pm

- **Eastern:** 10:30 am - 2:30 pm

COURSE LOGISTICS

Instructor's Hours

If it is urgent contact my text. If it is not urgent, contact me by email. I will be available via email and will respond as soon as I am available (generally within 24-48) hours. I live in the Mountain time zone and will typically not read work e-mails between 8 p.m. and 7 a.m. The best time to reach me by text will be M-Fr 8 a.m. to 6:00 p.m. mountain time; additional availability can be pre-arranged. However, I travel extensively for my day job so any given week I could anywhere, but I will try to give you notice in advance.

Virtual Office Hours

Virtual Office Hours are a synchronous session (through Zoom) to discuss questions related to weekly readings and/or assignments. Office hours intersession will be published in the course announcements. Other meetings with individuals or groups can be set up by appointment, please provide at least 1 day notice.

Course Etiquette Guidelines

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea but you are not to attack an individual. Our differences, some of which are outlined in the University's inclusion statement below, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience. Please read the Netiquette rules for this course:

- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an "open-mind" and be willing to express even your minority opinion.
- Think and edit before you push the "Send" button on any emails or text
- Do not hesitate to ask for feedback.

Attendance

Students are expected to attend all class sessions. Avoid making any other work or personal appointments during the scheduled sessions.

- In the event of either a business critical or personal critical impact, the student may be excused, with make-up work, as follows:

Time Missed	Approver	Make-Up Work
< 4 Total Hours	Course Instructor	Discretion of Instructor
4-8 Total Hours	Director, Systems Programs	Assignment Consistent with Missed Time
> 8 Total Hours	Director, Systems Programs	Student May be Required to Repeat Course

COURSE MATERIALS

Textbook(s):

Applied Space Systems Engineering: access through this **link** **(https://spacetechnologyseries.com/books/Applied-Space-Systems-Engineering.html)**

SMAD-Core: access through this **link** **(https://www.spacetechnologyseries.com/~spacet9/books/SMADCore.html)**

Materials: Course handouts and supplementary material will be posted in canvas

COURSE REQUIREMENTS

Course Logistics

- Deadlines are an unavoidable part of being a professional and this course is no exception. Course requirements must be completed and posted or **submitted on or before specified due date** and delivery time deadline. **Due dates and delivery time deadlines are defined as Eastern Time**(as used in Hoboken, NJ). Please note, students living in distant time zones or overseas must comply with this time and due date deadline policy. Avoid any inclination to procrastinate.

How to Approach this course:

- Review the material in the course handout prior to each session
- Review the reference chapters in the course text
- Actively participate during in-class discussions and exercises
- Work steadily throughout the semester on your individual project (don’t start it at the last minute!)
- Meet regularly throughout the semester with your project team

Participation

Be prepared to actively participate and contribute to in-class discussions and exercises.

TECHNOLOGY REQUIREMENTS

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Canvas

Technology skills necessary for this specific course

- Live web conferencing using Zoom
- Recording a slide presentation with audio narration
- Recording, editing, and uploading video via Panopto

Required Equipment

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection
- Webcam: built-in or external webcam, fully installed
- Microphone: built-in laptop or tablet mic or external microphone

Required Software

- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint
- System Tool Kit (STK) - access instructions to be provided separately

GRADING

Grades will be based on:

Class Participation	10%

Mission Design Exercise Presentation	10%
Mission Design Exercise Final Report	40%
Verification Plan	40%

Assignments requiring file submission must be submitted as **one .pdf per assignment**. All assignments will be reviewed within Canvas and feedback will be provided within Canvas versus file upload.

Late Policy

- 20% of the total points will be deducted for assignments received 1-6 days late (**without prior coordination**); assignments received more than 1 week late will receive 0 points. Some flexibility will be allowed for work travel or illness, please coordinate this ASAP.

ACADEMIC INTEGRITY

Generative AI Technologies

You may use AI programs e.g. ChatGPT to help generate ideas and brainstorm. However, you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Beware that use may also stifle your own independent thinking and creativity.

You may not submit any work generated by an AI program as your own. If you include material generated by an AI program, it should be cited like any other reference material (with due consideration for the quality of the reference, which may be poor).

Any plagiarism or other form of cheating will be dealt with under relevant Stevens policies.

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student’s submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and

adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at **https://my.stevens.edu/provost/grad-academics-and-student-success (https://my.stevens.edu/provost/grad-academics-and-student-success)** .

LEARNING ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit **https://www.stevens.edu/student-diversity-and-inclusion/disability-services (https://www.stevens.edu/student-diversity-and-inclusion/disability-services)** . If you have any questions please contact the Office of Disability Services at **disabilityservices@stevens.edu (mailto:disabilityservices@stevens.edu)** or by phone: 201.216.3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required

before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your pronouns and/or name, please inform the instructor of the necessary changes.

Religious Holidays

Stevens is a diverse community that is committed to providing equitable educational opportunities and supporting students of all ethnicities and belief systems. Religious observance is an essential reflection of that rich diversity. Students will not be subject to any grade penalties for missing a class, examination, or any other course requirement due to religious observance. In addition, students will not be asked to choose between religious observance and academic work. Therefore, students should inform the instructor at the beginning of the semester if a requirement for this course conflicts with religious observance so that accommodations can be made for students to observe religious practices and complete the requirements for the course.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments can be made by phone (201-216-5177), online at **https://stevensportal.pointnclick.com/confirm.aspx (https://stevensportal.pointnclick.com/confirm.aspx)** , or in person on the 2nd Floor of the Student Wellness Center.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about your own safety or the safety of someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year-round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources

for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text “Home” to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at **care@stevens.edu (mailto:care@stevens.edu)** . A member of the CARE Team will respond to your concern as soon as possible.