



Required components to a Purdue syllabus

This document was revised for Fall 2021 with the intent of returning to pre-COVID-19 academic policies that were created by the Purdue University Senate.

Course Information

Instructor(s) Contact Information

Course Description

Learning Resources, Technology & Texts

Learning Outcomes

Assignments

Grading Scale

Attendance Policy

Academic Guidance in the Event a Student is Quarantined/Isolated

Course Schedule

Classroom Guidance Regarding Protect Purdue

Academic Integrity

Nondiscrimination Statement

Accessibility

Mental Health/Wellness Statement

Basic Needs Security

Emergency Preparation

Course Information

- **Course number and title:** AAE 45000: Spacecraft Design
- **CRN:** 63827 (lecture), 63826 (team presentations)
- **Meeting day(s) and time(s).**
Lecture: T-Th 6:00-6:50 PM, ARMS 1010.
Team Presentations: T 10:30-1:20 WTHR 320
Student teams will arrange a 1 hour weekly meeting with the TA
- **Instructional Modality:** Face-to-Face
- **Course credit hours:** 3
- **Prerequisites:** Senior standing in AAE

Instructor(s) Contact Information

- **Name of the instructor:** Prof. James L. Garrison
- **Office Location:** ARMS 3311
- **Office Phone Number:** (765) 496-7482
- **Purdue Email Address:** jgarriso@ecn.purdue.edu
- **Student Consultation hours, times, and location:** Individual student meetings are available by appointment, either in office or online.

- **Name of the instructor:** Dr. Justin Mansell
- **Office Location:** ARMS 3212
- **Office Phone Number:** (765) 496-4011
- **Purdue Email Address:** jmansell@purdue.edu
- **Student Consultation hours, times, and location:** Individual student meetings are available by appointment, either in office or online.

- **Name of the instructor:** Prof. Dara Entekhabi (**MIT, as Neil Armstrong Distinguished Visiting Fellow**)
- **Email:** darae@mit.edu

Course Description

Official Course Description the University Catalog: Senior students perform a team-based spacecraft design, requiring application of the education and skills developed in the aerospace curriculum. Components include analysis methods for preliminary design, development of an initial vehicle concept, and development of a complete numerical model of the mission, culminating in oral and written reports by the teams

Additional Comments:

1. There will be an emphasis on learning ***methods and techniques*** of the design process, using current best practices, in addition to the application of the technical skills acquired earlier in the curriculum.
2. Systems engineering, project management, cost estimation, and mission assurance are important parts of the course.
3. Short overviews will be provided for specific technical areas required to perform the design of a space system. The emphasis will be on topics ***not presently covered in the undergraduate curriculum***.

4. The project will be a complete space system, including ground support, mission operations, and science product generation, in addition to the satellite hardware and launch vehicle selection and integration.
5. The final design will be presented in the form of a written proposal.

Learning Resources, Technology & Texts

Required text:

Space Mission Engineering: The New SMAD (SME-SMAD)
Microcosm Press, Wertz/Everett/Puschell
978-1881883159, August 2011, 1033pgs

Available for 100\$ directly from the publisher:

<https://astrobooks.com/spacemissionengineeringthenewsmadsme-smadwertzeverettpuschellavailablespring2011softcover.aspx>

Note – *as of August 2020, amazon.com and other online sellers are re-selling this at an unbelievable markup (~500\$). If you have trouble obtaining it from the publisher, contact Prof. Garrison.*

This is a standard reference, compiling much of the practical knowledge needed to design space systems, including key information on subsystems. This is an essential reference to own if you intend to work in the space field after graduation.

Additional readings: There will be additional readings for some of the sub-sections. All will be distributed through links to the specific module on the Brightspace page at the needed time.

Each module will include at least one reading from either a chapter in New-SMAD or a provided document.

Software/web resources: some recommended software will be provided through Brightspace. For some sub-system design problems, students are expected to determine the appropriate software tool, either provided by the university, available as open source, or developed on their own. ***Selection of the appropriate tools (including software) is an important part of the design process.*** Links to suggested tools will be provided on Brightspace. Students are expected to have access to and be familiar with the standard software used in engineering, including word processing, spreadsheets, presentation (e.g. Powerpoint) and computation (e.g. MATLAB). Students are free to choose the software and operating system that works best for their project team. Teams should set up a common cloud storage area (e.g. OneDrive or Google Drive) to share work among members.

Learning Online 101: students are automatically enrolled this course in Brightspace. It is a self-paced elective designed to help students be better prepared for hybrid and online learning as described in this [announcement](#).

Brightspace learning management system (LMS)

Access the course via Purdue's Brightspace learning management system. Begin with the Start Here tab, which describes how the course Brightspace is organized. It is strongly suggested that you explore and become familiar not only with the site navigation but with content and resources available for this course. See the Student Services widget on the campus homepage for resources such as Technology Help, Academic Help, Campus Resources, and Protect Purdue.

The course Brightspace page: <https://purdue.brightspace.com/d2l/home/329720>

Learning Outcomes

On completing this course, the student shall be able to:

1. Learn structured methods to design complex systems meeting customer requirements. Apply these methods to the design of a space system.
2. Understand basic models for typical spacecraft sub-systems (e.g. attitude control, communications, propulsion, etc ...). Demonstrate the application of these models to make preliminary design decisions and for sub-system sizing.
3. Develop a cost estimate, budget, schedule, and risk assessment for a space system design.
4. Give oral presentations and write technical reports and proposals.

Assignments

Design Project/Proposal:

The entire curriculum of AAE450 is based around a team project, intended to be conducted under the same conditions as an actual proposal development by professional space systems engineers. **A single numerical score will be assigned to all members of the project team**, assessing the team performance as a whole. This score will be based on the final proposal and presentation. Feedback from the mid-term (Blue Team) and final (Red Team) reviews is intended for teams to use to identify any problems with their design early in the process and allow them the opportunity to correct them. Therefore, **the final score will be determined only by the final proposal (75%) and presentation (25%).**

A committee of engineers and scientists, who are colleagues of Prof. Garrison, may assist in the reviews. They will be asked to evaluate the final proposal as if it were an actual submission seeking funding. Prof. Garrison will base the final numerical score for the project on these reviews and his own. A general rubric, derived from the stated proposal criteria will be provided.

In addition to a request for detailed, specific feedback, the committee will be asked to answer the following question:

“If you were to receive this proposal in response to an actual announcement of opportunity, would you recommend it for selection and funding ?”

One criteria for a final score of “A” (93% or above) is an affirmative response to this question by a majority of the review committee.

Participation:

All students are expected to attend all lectures, presentations and project team meetings, either in person or online. Students with an excused absence need to **email Dr. Mansell** (jmansell@purdue.edu). Attendance will be taken at random class meetings. ***Unexcused absences will result in a reduction of an individual student’s final grade from that assigned to their team.*** (Details given below)

Weekly Project Questions:

Teams will work together each week to answer a set of open-ended questions intended to apply material in the lectures to the specific design decisions that they will be making for the project. The written response to these questions should be prepared as a team activity and submitted before the weekly team presentation. ***Failure to submit this work will result in a reduction of the final score for the entire team.*** (Details given below)

Adjustment of Final Scores:

Although the entire team will receive the same score for their project based on final proposal/presentation, there are three (3) adjustments that can be made to this score before assigning a letter grade.

1) Individual student participation. – each student is allowed a **total of two (2) unexcused absences** from any course lecture, team presentation, or team meeting. Any additional absence will result in a **reduction of 5 points** for that individual student's final score.

No unexcused absence is allowed for the mid-term or final presentations. Missing either of them will result in a 5-point reduction.

2) Missing Weekly Questions - Each failure to turn in a written response to the weekly lecture questions will result in a **5 point reduction** to the team's final score.

3) Special (Rare) Cases – All members are expected to make a substantial contribution to their team's project. If a student is found not to be contributing, they will be given one warning and assigned a specific set of mitigation tasks to catch up. If they are not able to complete these tasks, requiring that other members of the team take on additional work, their **final score will be reduced by a MINIMUM of one letter grade (10 points)** lower than the final team score.

Alternatively, if certain members of the team must put in exceptional effort to overcome unexpected circumstances, their final scores may be raised above that of the team score.

Students are expected to remain on the same team for the entire course. If circumstances require that a student change teams, their final score will be a weighted average of the scores of their new and old teams. The exact specifications of the weighting will be set in a mutual agreement made between the student and Prof. Garrison at the time of the transition.

All of the situations in (3) are expected to be rare and exceptional.

Grading Scale

Grading Philosophy: Final grades should measure the success of the team in applying material taught in the course, along with knowledge of the core AAE curriculum, to a practical design project. Each project will be evaluated on its' own merit, not relative to the other teams. Repeating the statement given earlier, the essential question asked in the final review will be:

“If you were to receive this proposal in response to an actual announcement of opportunity, would you recommend it for selection and funding ?”

One criteria for A final score of “A” (93% or above) is an affirmative response to this question by a majority of the review committee. The final numerical score for individual students, computed from their team score with the adjustments described in the previous section will be directly converted to a letter grade according to the intervals in the following table;

- A+: ≥ 97
- A: [93, 97)
- A-: [90, 93)
- B+: [87, 90)
- B: [83, 87)
- B-: [80, 83)
- C+: [77, 80)

- C: [73, 77)
- C-: [70, 73)
- D+: [67, 70)
- D: [63, 67)
- D-: [60, 63)
- F: <60

Academic Dishonesty: If violations such as plagiarism or failure to properly cite sources are discovered prior to the submission of the mid-term or final report, the team will be given written notice and will be required to make the appropriate corrections before submission of the mid-term or final proposal. If such violations are discovered in the submitted product, the team will be required to re-write the document and will receive a course final score reduction of **at least** one letter grade (10 points).

More serious violations will result in a failing grade and referral to the Dean of Students. Please refer to the **Academic Integrity** section for details of the policy.

Attendance Policy

The University expects that students will attend classes for which they are registered. At times, however, either anticipated or unanticipated absences can occur. The student bears the responsibility of informing the instructor in a timely fashion, when possible. The instructor bears the responsibility of trying to accommodate the student either by excusing the student or allowing the student to make up work, when possible. The University expects both students and their instructors to approach problems with class attendance in a manner that is reasonable.

Attendance may be taken in any of the lectures, presentation times, or team meetings. As stated earlier, each student is allowed a **total of two (2) unexcused absences** from any course lecture or team presentation. Any additional absence will result in a **reduction of 5 points** for that individual student's final score. No unexcused absence is allowed for the mid-term or final presentations. Missing either of them will result in a 5-point reduction.

Any absence that results from following the **Protect Purdue Pledge** (e.g. staying home when ill or in quarantine) will be considered an excused absence.

Physical presence in the classroom is not the same as engagement. Students should actively participate in discussions, answering questions and interacting with colleagues.

As will be described in the course organization, each team will give a weekly presentation led by the project manager and including 5-10 minutes of material presented by one team member. **Every team member should present at least one time during the course.** Inclusion of all team members in the design decisions and presentations is essential for a successful project. This also gives the opportunity for the project manager to develop skills in team leadership and delegation as they will be the final representation of the team to "management" (i.e. the instructors).

Academic Guidance in the Event a Student is Quarantined/Isolated

If you must miss class at any point in time during the semester, please reach out to one of the instructors (Garrison: jgarriso@purdue.edu or Mansell: jmansell@purdue.edu) via email so that we can communicate about how you can maintain your academic progress. If you find yourself too sick to progress in the course, notify your adviser and one of us via email or Brightspace. We will make arrangements based on your particular situation. Please note that, according to Details for Students on Normal Operations for Fall 2021 announced on the Protect Purdue website, "individuals who test positive for COVID-19 are not guaranteed remote access to all course activities, materials, and assignments."

Course Schedule

The course is organized into weekly modules on the Brightspace page. The standard format for the KTH week is as follows:

Week (K-1) Thursday - New module released. Reading assignment and pre-record lecture video. Teams given short assignment on applying reading to their project. Note: Most of the lectures will be pre-recorded, with class meeting time devoted to details specifically related to the project and an opportunity to answer questions. ***It is important that all students watch the lecture videos before the first class meeting on Tuesday.***

Week K Tuesday 10:30-1:30 (WTHR 320) - Team presentations. 15 min. each + 5 min for questions. Project Manager (PM) should lead the presentation with 5-10 min. presented by one team member. Team members should rotate throughout the term with each member presenting at least once.

Week K Tuesday 6:00-6:50 PM – Lecture/Q&A on the pre-recorded video. Course announcements. General (to entire class) feedback on presentations.

Week K Thursday 6:00-6:50 PM - lecture/Q&A on the pre-recorded video and reading

Week K Friday – Team assignment due.

The format will vary slightly for the first week of class, weeks with project reviews, and weeks with holidays.

DRAFT schedule below. ***Some re-organization may occur. The most current one will be on Brightspace.***

Dates	Topic	Lecturer		Reading	HW Due
		Tu	Th		
8/24, 8/26	Introdcution	Garrison	Garrison	Background Videos & mission links	8/27
8/31, 9/2	Mission Formulaton	Garrison/Entekhabi		SME Ch 1-3, Dara E video	9/3
9/7, 9/9	Concept Exploration	Garrison	Seho Kim	SMAD 4, SMAP STM	9/10
9/14, 9/16	Systems Eng	Raymond	Garrison	SMAD 5, 6, Faure SSVI	9/17
9/21, 9/23	Preliminary Design & Sizing	Garrison	Garrison	SMAD 14 & 15,	9/24
9/28,9/30	Cost Estimation	Suzanna D	Seho Kim	SMAD 11, Saing SSVI	10/1
10/5, 10/7	Project Management & SMA	Sachi	Leitner	Norton SSVI, SMAD 24	10/8
10/14		Q/A	Blue Team Review		10/15
10/19, 10/21	Space Environments	Campola	Schone (SSV	SMAD 7, SSVI Schone	10/22
10/26, 10/28	Communications	Garrison	Garrison	SMAD 16, Minelli SSVI, Murbach SSVI	10/29
11/2, 11/4	Software & Processors	Shah	Bellard (SSV	SMAD 20,21.1 Bellardo (SSVI)	11/5
11/9, 11/11	Thermal Control/Power	Yendler	Kim	SMAD 21.2,22	11/12
11/16, 11/18		Q&A	Red Team Review		11/19
11/23					
11/30, 12/2		Q&A	Final Presetation		12/3
12/7, 12/9	Dead Week				
12/17	Finals week				

The Purdue [Academic Calendar](#) shows key University dates for the Fall 2021.

Classroom Guidance Regarding Protect Purdue

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#) and the Violent Behavior Policy under University Resources in Brightspace.

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information is submitted the greater the opportunity for the university to investigate the concern. More details are available on our course Brightspace table of contents, under University Policies.

As stated in the Grading Policy: If violations such as plagiarism or failure to properly cite sources are discovered prior to the submission of the mid-term or final report, the team will be given written notice and will be required to make the appropriate corrections before submission of the mid-term or final proposal. If such violations are discovered in the submitted product, the team will be required to re-write the document and will receive a course final score reduction of at least one letter grade (10 points).

Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. A hyperlink to Purdue's full [Nondiscrimination Policy Statement](#) is included in our course Brightspace under University Policies.

Accessibility

Purdue University is committed to making learning experiences accessible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#). Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the [Office of the Dean of Students](#). Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a [Purdue Wellness Coach at RecWell](#). Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the [Critical Needs Fund](#)

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Please refer to:

[ARMS Building Emergency Plan \(BEP\):](#)

[WTHR Building Emergency Plan \(BEP\):](#)

[Emergency Preparedness Safety Briefing](#)