This dual syllabus covers both MECH 5334 Space Systems Design (graduate course) and the associated cross-listed MECH 4395 Special Topics (undergraduate course). Course delivery and content is the same for both courses. Differences in assessment expectations are clearly outlined throughout the syllabus.

**Course description:**
Space missions vary widely in scope and purpose, from student-led CubeSat development through to robotic lander and crewed exploration of the Solar System. In all cases, space missions require multiple subsystems operating together in a wide range of environmental conditions, developed through the collective cooperation of interdisciplinary teams under stringent operational constraints. This course provides an overview to the process and tool required to develop a successful space mission, from mission conception and spacecraft design through to launch, operations, and end-of-life.

The course covers the entire space mission lifecycle. We begin with the development of the mission concept and its geometry, mission requirements definition, space policy, cost estimation, and scheduling. Once these are defined, the spacecraft design requirements, payload, and satellite subsystem are developed, including space environment considerations, structures, thermal, power, communications, propulsion, and control. Finally, operational aspects are considered, from testing to launch and end-of-life disposal, including required ground support systems.

You will come away from this course with an appreciation of the process and tools needed to implement a successful space mission that you can apply and refine into the future. The project-based nature of the course is designed to encourage development of the teamwork skills needed for the interdisciplinary and collaborative aerospace industry.

**Prerequisites:**
None.

A fundamental understanding of linear algebra, partial differential equations, and probability, and basic coding skills in a mathematics environment (eg. Matlab, Python) are assumed.
**Course structure:**
*Subject to change based on local conditions at the time of instruction.*

The course will be taught using the flipped classroom method. This consists of

1) Pre-recorded video lectures watched PRIOR to scheduled class time
2) Short quizzes about lecture content to be completed PRIOR to scheduled class time.
3) Active participation classes consisting of worked examples, case studies, and project problem solving with direct instructor supervision
4) A team-based semester long project to apply to learned skills in a manner realistic to industrial practices and employer expectations.

**Course outcomes:**
By the end of this course, you should be able to:

1) Formulate mission and spacecraft requirements from stakeholder, environmental, political, and technological constraints
2) Apply defined requirements to formalize mission and spacecraft design
3) Develop cost, risk, and schedule estimates for complex space missions
4) Evaluate launch, operation, and disposal requirements for space missions

**Textbooks and Other Useful References:**
Complete course notes and lecture videos are available through the course Blackboard page.

The course closely follows 'Space Mission Engineering: The New SMAD' ([http://www.sme-smad.com/](http://www.sme-smad.com/)), an industry standard text for anyone involved in space missions. It is NOT a required textbook, but is an incredibly useful resource both for this class and any future work in the aerospace field, and is therefore highly recommended. It can be expensive through certain popular websites, so please shop around if you are looking to buy a copy.

*Current Edition:*

The NASA Systems Engineering handbook ([https://www.nasa.gov/connect/ebooks/nasa-systems-engineering-handbook](https://www.nasa.gov/connect/ebooks/nasa-systems-engineering-handbook)) is another very useful resource that covers the general systems engineering process of technology and mission development with an aerospace focus. It is expected all students download and refer to this resource throughout the course.

Recommendations for other resources for additional details on specific topics will be included at the relevant point in course materials.
Course Topics:
The course is fundamentally broken into two sections, each consisting of a series of progressive sub-sections.

1  Space Mission Engineering  
   (8 weeks)  
   a. Mission architectures, concepts, and timelines. 
   b. Mission and spacecraft requirements definition. 
   c. Astrodynamics, and the space environment. 
   d. Space policies. 

2  Spacecraft Design and Technologies  
   (6 weeks)  
   a. Payload and spacecraft bus overview 
   b. Sub-system technologies: on-board processing, communications, power, propulsion, controls, structures, and thermal protection 
   c. Estimating cost, risk, and reliability 

Assessment and Grading: 
Assessment items are specifically designed to gauge student engagement in and understanding of course material while maintaining relevance to skills required in the workforce.

1) Multiple choice quizzes about content covered in pre-recorded video lectures.  
   Individual, 40% of overall grade

2) Participation grade awarded based on activity in class activities, seminars, forums, etc.  
   Individual, 10% of overall grade

3) A team project with step-wise submissions culminating in a final presentation and report.  
   Literature Review, Team, 10% of overall grade 
   Mission Concept Review, Team, 15% of overall grade 
   Preliminary Design Review, Team, 25% of overall grade

All assessment is distributed and submitted online through Blackboard. For more information on submission locations and dates related to assessable items, refer to the schedule and Blackboard.

Assessment expectations will be at a higher standard for students enrolled MECH 5334.

Overall grades will be awarded based on the following scale: A = 100%-90%, B=89%-80%, C = 79%-70%, D=69%-60%, F<60%. Final percentage grades will be rounded up to the nearest integer at the end of the course.

<table>
<thead>
<tr>
<th>Grade Scale</th>
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<tbody>
<tr>
<td>100-90%</td>
<td>A</td>
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<tr>
<td>89-80%</td>
<td>B</td>
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<tr>
<td>79-70%</td>
<td>C</td>
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<tr>
<td>69-60%</td>
<td>D</td>
</tr>
<tr>
<td>&lt;60%</td>
<td>F</td>
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</tbody>
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Extension Requests and Assessment Excusals: Extensions for assessable item due dates, and excusal for assessable activities or exams will only be granted for University approved reasons as outlined in the catalog. These include participation in University-recognized activities, Religious Holy days, Military Leave.  
http://catalog.utep.edu/undergrad/academic-regulations/curriculum-and-classroom-policies/
Attendance and Participation:
All students are required to watch the pre-recorded videos and submit the associated quizzes before class time. Those who have not will not be permitted in the classroom. Participation in class activities is expected as this is an essential part of the learning process in the flipped classroom approach and required to support your project teammates.

COVID-19 PRECAUTION STATEMENT
Please stay home if you have been diagnosed with COVID-19 or are experiencing COVID-19 symptoms. Please immediately inform your project team mates and work with them to ensure progress continues. Inform Dr. Greig via email so that your participation grade is not affected.

If you have tested positive for COVID-19, you are encouraged to report your results to covidaction@utep.edu, so that the Dean of Students Office can provide you with support and help with communication with your professors. The Student Health Center is equipped to provide COVID-19 testing.

The Center for Disease Control and Prevention recommends that people in areas of substantial or high COVID-19 transmission wear face masks when indoors in groups of people. The best way that Miners can take care of Miners is to get the vaccine. If you still need the vaccine, it is widely available in the El Paso area, and will be available at no charge on campus during the first week of classes. For more information about the current rates, testing, and vaccinations, please visit epstrong.org.

Inclusion
My goal for the classroom is to have an engaging, intellectual, and safe learning environment. I aim to foster open communication and discussion. Due to the diversity of individual beliefs, backgrounds, and experiences, I expect every member of this class (myself included) to show respect for every other member of this class. If you feel that you are not being respected in this course or our department in anyway, please come see me, another mechanical faculty/staff member you are comfortable approaching, or the Student Engagement and Leadership Center.

Course Communication:
All course content, assessment details, announcements, and other course information will be available on the Blackboard course page. Please make Blackboard your first stop for course information and be sure to check it regularly for updates. Relevant course information may also be periodically sent to your UTEP email. Please be sure to check your email on a regular basis.

Please post your questions regarding the course material and assessment on the forums provided on Blackboard. This way, all students can benefit from the interaction. All questions will be answered within one working day and inside regular working hours only. Questions about course content asked through email will not be answered.

Please use only in-person or email interaction for questions on grading and/or personal issues. All questions will be answered within one working day and inside regular working hours only.
University Support Services:
The following services are just some of many offered by the department and UTEP. Please make use of them to improve your educational experience.

ACES & Tutoring Center:
Please note there are tutoring services available in the ACES center. Tutoring is provided free to you by the Department. If tutors are not used, the Department may stop funding them. Check the schedule of the tutors and make use of the services. For more details visit ME Advising Blackboard -> cc mech acadav: MECH Academic Advising -> Tutoring & Resources. At the link you can find tutor schedules, location of the ACES center and the list of tutors available. For more information send email to METutors@utep.edu

Reasonable Accommodation Policy:
If you have a disability and need classroom accommodations, please contact the Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

Mental Health Concerns
A recent American College Health Survey found stress, sleep problems, anxiety, depression, interpersonal concerns, death of a significant other and alcohol use are among the top ten health impediments to academic performance.

The University of Texas at El Paso (UTEP) offers students, including veterans and active duty, a wide range of mental-health related resources on and off campus. The on campus resources include counseling and treatment when there is a need, to support for recovery. For a list of all support services available visit https://www.utep.edu/student-affairs/resources/Mental-Health-Resources-for-UTEP-Students.html

Course and University Policies:
Complete University academic policies and regulations can be found In the UTEP catalog. http://catalog.utep.edu/undergrad/academic-regulations/

Academic Integrity
The University of Texas at El Paso prides itself on its standards of academic excellence. In all matters of intellectual pursuit, UTEP faculty and students must strive to achieve excellence based on the quality of work produced by the individual. In the classroom and in all other academic activities, students are expected to uphold the highest standards of academic integrity. Any form of academic dishonesty is an affront to the pursuit of knowledge and jeopardizes the quality of the degree awarded to all graduates of UTEP. It is imperative, therefore, that the members of this academic community understand the regulations pertaining to academic integrity and that all faculty insist on adherence to these standards.
Any student who commits an act of academic dishonesty is subject to discipline. Academic dishonesty includes, and is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, and any act designed to give unfair advantage to a student or the attempt to commit such acts. Proven violations of the detailed regulations, as printed in the Handbook of Operating Procedures (HOP), and available in the Office of Student Life and on the homepage of the Office of Student Life at www.utep.edu/dos, can result in sanctions ranging from disciplinary probation, to a failing grade on the work in question, to a failing grade in the course, to suspension or dismissal, among others.

While I encourage collaboration between students in order to understand the course material, assignments submitted for grading MUST be done by each student independently. Inappropriate collaboration (also known as cheating) includes:

- Using all or parts of assignments, exams, or projects from this year or any previous year that were not created by you personally;
- Talking, passing information, or using inappropriate materials during an in-class exam

Anyone found to be participating in inappropriate collaboration may be immediately failed from the course and subject to disciplinary action.

You must show your working for all problems submitted for grading. The instructor may require you to explain how you solved a problem on an assessable item at any time after submission. If you refuse or cannot explain your work you may be subject to disciplinary action.

If you are suspected of scholastic dishonesty you may or may not be directly confronted about your conduct by the instructor or proctor. You will however, be reported to the Office of Student Conduct and Conflict Resolution (OSCCR). Your grade in the class may not be available until OSCCR makes a final ruling, this may adversely impact your ability to enroll in other classes.

Harassment Policy

The University (see Handbook of Operating Procedures 1.2.2.4) has a zero-tolerance policy for harassment. Engagement in any behavior considered harassment will be reported to the proper authorities. In addition to generally understood forms of harassment, the department also treats the following behavior as harassment:

- Repeated emails and/or calls regarding subjects that have already been addressed. Once a decision has been made or a question answered, a student who continues to ask the same question will be given a warning by the recipient of the email/call. If the student continues, the behavior will be reported. Questions that seek understanding of course material are not harassment; but repeated questions about a grade or an administrative decision are.
- Grades are NOT negotiable, ever. If you believe a grading mistake has been made, you must follow the process described in the UTEP catalog. Any request for a grade
elevation that is NOT based on a mistake is considered harassment and will be reported immediately.

- Remaining in an office after the occupant requests you leave is considered harassment and potentially threatening. You will be reported immediately without warning and depending on the severity, may be reported to law enforcement.
- Similar behavior towards department staff, and student advisors will also be treated as harassment, including persistent phone calls, emails, and badgering. Department staff and student advisors are there to help students, and should be treated with due respect.

**Student Conduct**

While enrolled at the University, a student neither loses the rights nor escapes the responsibilities of citizenship. Any student who engages in conduct that is prohibited by the Board of Regents' *Rules and Regulations* or University rules or by federal, state, or local law is subject to discipline whether such conduct takes place on or off campus or whether civil or criminal penalties are also imposed for such conduct. All students are expected and required to obey the law, to show respect for properly constituted authority, and to observe correct standards of conduct.

The University of Texas at El Paso administers student discipline according to established procedures of due process. Procedures are defined and described in the *Rules and Regulations* of the Board of Regents, Rule 50101, and in the *Handbook of Operating Procedures* (HOP). Students should check with appropriate departments whose policy or regulation is of concern. If necessary, students need to refer to the rules in the Regents' *Rules and Regulations* ([http://www.utsystem.edu/bor/rules](http://www.utsystem.edu/bor/rules)) and the HOP. The Office of Student Life can assist on this matter. This set of rules is available at [https://www.utep.edu/vpba/hoop/](https://www.utep.edu/vpba/hoop/).

**Family Educational Rights and Privacy Act (FERPA)**

*The Family Educational Rights and Privacy Act (FERPA)*, 20 U.S.C. §1232g and the *Texas Public Information Act, Texas Government Code*, § 552.001, et seq., are federal and state laws that provide students the following rights with respect to their student educational records. The University of Texas System and The University of Texas at El Paso have implemented a student records policy that adheres to these laws. For more information regarding the University’s implementation of these laws, please review the [Handbook of Operating Procedures](https://www.utep.edu/vpba/hoop/).