



SPST 513 Nuclear Space Propulsion

2026 Fall

Meeting Information

In-person RH-111 Mo, We: 11:15-12:30 p.m.

Online session: Tu, 8:00-9:00 p.m.

In-person attendance is compulsory for on-campus students.

Online evening attendance is compulsory for distance students.

About the Professor & Contact Information



Marcos Fernandez-Tous

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CH-534

<https://und.edu/directory/marcos.fernandeztous>

Course Description

This course is designed to explore the application of nuclear reactors to space propulsion in their two main versions: nuclear thermal (NTP) and nuclear electric (NEP) propulsion. This new edition has been created with suggestions of members of the American Institute of aeronautics and Astronautics' (AIAA) Nuclear and Future Flight Propulsion (NFFP) technical panel. The proposed schedule covers the physics of nuclear propulsion, the application of these principles to rocket propulsion, and an analysis of the most recent proposals in

the field of nuclear space propulsion. Students interested in the area will get a solid formation on the technology that not only will propel spacecraft in deep-space mission, but may also serve to produce energy in space and on celestial bodies.

Course Objectives/Learning Outcomes

After successfully completing this course, you should be able to master four course outcomes (CO), at different levels (Bloom's taxonomy):

Course outcomes	
CO01	The student will be able to comment on aspects of nuclear physics by combining information in a way that clearly aligns with the scientific discourse.
CO02	The student will be able to determine the functioning of any technological element in a nuclear fission reactor for space propulsion.
CO03	The student will be able to analyze the operation of a nuclear fission reactor for space propulsion as part of a space system.
CO04	The student will be able to comment on aspects of nuclear fusion and other advanced concepts applied to space propulsion by combining information in a way that clearly aligns with the scientific discourse.

Course Policies

Academic Integrity Course Policy

Students are expected to complete all academic work honestly and responsibly. For more information read the Code of Student Life. The instructor will provide guidance on academic integrity in the course and on specific assignments. If you have any questions about what constitutes appropriate collaboration, citation, or use of sources, please ask before submitting your work.

Violations of academic integrity may be reported to the [Community Standards and](#)

[Care Network](#). Please see the [Code of Student Life](#) for more information.

Attendance Policy

Attendance and participation in class activities are considered integral parts of a university education. It is the University policy that attendance in classes is expected of all students. If attendance and/or participation are required and will impact grading, it is the responsibility of the instructor to communicate clearly that policy to students during the first week of class in the course syllabus.

Even in situations where an instructor might excuse a class absence, e.g., severe medical situations, family emergencies, military service, or authorized University activities, it is the responsibility of the student, whenever possible, to inform the instructor ahead of time.

Artificial Intelligence (AI) Course Policy

The instructor will provide guidance on the use of AI in this course and on specific assignments. Please ask your instructor if you have any questions.

Communication Policy

You are expected to utilize official UND communication channels. Your UND-provided email address is considered your official email address for communication with faculty and staff. It is important to check your UND email daily. You are also expected to regularly log-in to other official UND accounts including Hawk Central, Blackboard, and Campus Connection to receive and update important information. Hawk Central provides comprehensive tools for you to connect with UND resources, create personalized graduation plans with your academic advisor, and plan your class schedules. Blackboard is UND's Learning Management System connecting students and faculty and providing course information and materials. Campus Connection is where your mailing addresses, phone numbers, and personal information can be updated.

Exam/work Make-Up/Retake Policy

Please contact your instructor with questions about make-up work and retaking missed exams.

Submission of Late Work Policy

Due dates for each assignment or activity will be posted in Blackboard and/or within this syllabus. All assignments must be submitted by the due date and time posted in the course. All times are posted in the Central Time Zone.

The acceptance of late assignments is at the discretion of the instructor. If extenuating circumstances arise, it is your responsibility to you contact the instructor prior to the due date and request an extension. All requirements for this course must be completed during the course dates.

Assessment Details

In this course your learning will be assessed in the following ways:

- **Attendance.** Since this is a highly interacting class, video cameras must be on at all times during the online sessions.
- **Acquisition of pieces of knowledge considered essential to master for the course, in the form of pillar tokens.**
- **Implementation of a collaborative project, measured by the earning of milestone tokens.**

An explanation of these element is provided below.

Attendance

Course attendance is compulsory, since course objectives cannot be attained without maximizing a cooperative environment. But this is not sufficient. Active participation is key. For example, in some sessions, students may be selected to present their tentative results from the assignment to the rest of the class. Online students are highly encouraged to submit their questions through blackboard for the current pillar or their project.

Attendance will be registered and if unjustified absences occur through the semester, or the student's engagement in the course is unsatisfactory, it will be duly reflected in the final grade, so that an initial B may lead to a C, a C to a D, etc.

Tokenized pillar assignments

Bi-weekly assignments help earn tokens. Each of the assignments description can be found in the corresponding folder of the week.

Eight pillar assignments will be open through the course in specific dates. These assignments will be peer-reviewed by two students before the final grade and associated token award. The list of pillar assignments is presented below. They have been designed to reflect an interdisciplinary approach to nuclear space propulsion, and as the prompts reflect, they are intended to be open-ended, so that students can approach it from different angles depending on their interest and motivation. The content of each assignment is specified in each prompt.

- Historical analysis.
- Your own voice (an assignment in times of AI).
- Commented bibliography.
- Patent analysis.
- Poster presentation.
- AI research assignment (tentative; it might be replaced by another token).
- Numerical analysis.
- Your own assignment.

Your project on Nuclear Space Propulsion

You must make weekly progress on your project. Weekly progress will help you earn project tokens.

The following milestones apply:

1. Identification of a gap (20 gap tokens). To be valid, a gap must be: new and important. Watch [this video](#) on Writing effectively to understand these requisites.
2. Propose a solution (20 solution tokens). The solution proposal involves the design of it, short of implementation.
3. Implement the solution of your choice with an impact outside the classroom (20 impact tokens).

Notice that milestones also have deadlines.

Grading Scale

Grading Scale	
A	90-100
A/B	80-89
C	70-79
D to F	60-69 (D), <60 F. E grade might be assigned in specific cases.

For more information on grading review [UND Grading Policies](#).

University of North Dakota Academic Policies

Incomplete Policy

It is expected that students will complete all requirements for a course during the time frame of the course. For reasons beyond a student's control, and upon request by the student or on behalf of the student, an incomplete grade may be assigned by the instructor when there is reasonable certainty the student will successfully complete the course without retaking it. The mark "I," Incomplete, will be assigned only to the student who has been in attendance and has done satisfactory work up to a time within four weeks of the close of the semester, including the examination period, and whose work is incomplete for reasons satisfactory to his or her instructor. More information regarding UND's Incomplete policy can be found on [The Grading System Webpage](#).

Academic Grievance Policy

If you have a concern about this course, you should first contact your instructor. If you would like to initiate a formal academic grievance, defined by [UND's Code of Student Life](#) as "a statement expressing a complaint, resentment, or accusation lodged by a student about an academic circumstance (such as assessment, grading, testing, quality of instruction) which is thought by the student to be unfair," please review the college's grievance process. If you have any questions, contact the college dean's office.

Final Exam Policy

If a student has three or more finals scheduled the same day, the student may request an accommodation regarding final exams by contacting their instructors by the deadline to establish a mutually acceptable time to reschedule one or more of the exams. A student who is absent from a regularly scheduled examination without an excuse considered valid by the instructor is normally given an F for the course. If the excuse is valid, the policy on incompletes will apply. [Review the full final exam policy](#).

Course Evaluation

Near the end of the semester, you will be asked to complete an online course evaluation form.

- Please let me know which aspects of the course helped you learn—and which aspects might be modified to help future students learn more effectively.
- Please note that the course evaluations are anonymous and that I won't see the results until after the grades for the course are submitted, allowing you to provide honest and constructive feedback.

University of North Dakota Compliance Policies

Accessibility Statement

The University of North Dakota is committed to providing equal access to students with documented disabilities. To ensure access to your classes and program, please contact [Student Disability Resources](#) to engage in a confidential discussion about accommodations for the classroom, clinical and/or online course settings.

Accommodations are not provided retroactively. Students are encouraged to register with [Student Disability Resources](#) at the start of their class/program. More information can be obtained by email; UND.sdr@UND.edu, or by phone at 701.777.2100.

Religious Accommodations

UND offers religious accommodations, which are reasonable changes in the academic environment that enable a student to practice or observe a sincerely held religious belief without undue hardship on the University. Examples include time for prayer or the ability to attend religious events or observe a religious holiday. To request an accommodation, complete the [student religious accommodation request form](#). To learn more, please consult [UND's Religious](#)

[Accommodations Policy](#) or contact the [Civil Rights & Title IX Office](#).

Pregnancy Accommodations

Students who need assistance with academic adjustments related to pregnancy or childbirth may contact the [Civil Rights & Title IX Office](#) or Academic Affairs to learn about your options. Additional information and services may be found at [Pregnancy Resources](#) and in [UND's Protections for Pregnant and Parenting Students and Employees Policy](#).

Notice of Nondiscrimination

The University of North Dakota is committed to the principle of equal opportunity in education and employment. UND does not discriminate on the basis of race, color, national origin (including shared ancestry/ethnicity), religion, sex, age, disability, sexual orientation, gender identity, pregnancy or pregnancy-related condition, genetic information, marital or parental status, veteran's status, or political believe or affiliation or any other status protected by law.

Concerns regarding Title IX, Title VII, ADA, and Section 504 may be addressed to:

Donna Smith, Assistant Vice President for Civil Rights & Title IX
314 Twamley Hall
701.777.4171
UND.civilrights@UND.edu

or

The Office for Civil Rights
U.S. Dept. of Education
Cesar E. Chavez Memorial Building
1244 Speer Boulevard, Suite 310
Denver, CO 80204-3582
303.844.5695
Fax: 303.844.4303

The [Notice of Non-Discrimination](#) is available online through Civil Rights & Title IX.

Reporting of Discrimination, Harassment, or Sexual Misconduct

If you or a friend has experienced sexual misconduct, such as sex-based harassment, domestic violence, dating violence, or stalking, please contact the [Civil Rights & Title IX Office](#) or [UND's Title IX Coordinator](#) for assistance at 701.777.4171.

You may also contact the Civil Rights & Title IX office if you or a friend has experienced discrimination or harassment based on a protected class, such as race, color, national origin, religion, age, disability, sex, sex characteristics, sexual orientation, gender identity, genetic information, pregnancy, marital or parental status, veteran's status, or political belief or affiliation.

Faculty Reporting Obligations Regarding Discrimination, Harassment, or Sexual Misconduct

It is important for students to understand that faculty are required to share with UND's Civil Rights & Title IX Office any incidents of potential sexual misconduct or of discrimination or harassment based on a protected class that they become aware of, even if those incidents occurred in the past or are disclosed as part of a class assignment. This does not mean an investigation will occur if the student does not want that, but it does allow UND to provide resources to help the student continue to be successful at UND. If you have been impacted by discrimination, harassment, or sexual misconduct, you can find information about confidential support services at the [Civil Rights & Title IX webpage](#).

Health and Safety

UND is committed to maintaining a safe learning environment and asks students and instructors to be flexible when necessary to promote quality learning experiences.

Please do not attend an in-person class or lab if you are feeling ill or if you have been directed by health professionals to stay home.

- If you are not able to attend class or lab, please notify your instructor as soon as possible and discuss options for making up any missed work.
- If you will have an extended absence due to serious illness or other uncontrollable circumstances, you may request an absence notification through [Community Standards and Care Network](#).
- If your instructor is ill, they may need to cancel class or temporarily move your course to online delivery.

Please contact [Student Health Services](#) if you have health questions by calling 701.777.4500 or visiting myhealth.UND.edu

Student Success Resources

UND cares about your success as a student. For more information, visit the [Student Resources Page](#) for additional information. Students have access to assistance from the [UND Writing Center](#), [Academic Support Services](#), [Academic Advising Services](#), and more.

Students also have access to the UND Student Resource Site via Blackboard. It is recommended that you become familiar with the tools and tutorials within Blackboard to better equip you in navigating the course and [Academic Technologies](#).

UND Cares Program and Additional Resources

UND Cares Program

The Care Team is available to assist with incidents involving UND students 24 hours a day, seven days a week. Examples of such incidents include, major accidents, missing students, death, suicidal ideations, situations involving self-harm, psychological trauma and sexual violence.

The purpose of the Care Team is to facilitate communication between the students, families and the university. For more additional information, please visit the [UND Cares Program Webpage](#).

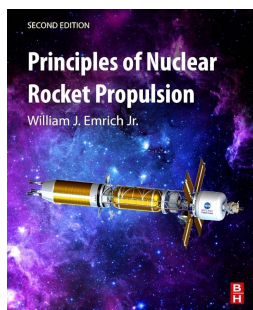
Additional Resources

If, at any point, you feel like the information covered in this class elicits thoughts, feelings, or concerns that you would like to discuss further, don't hesitate to reach out to your instructor or the UND Counseling Center (701.777.2127).

Further, if you experience extenuating circumstances, sexual violence, identity-based harm, or any other personal crisis during the semester, reach out to your instructor so they can provide academic assistance in this course, and put you in contact with the appropriate resources and services (if needed).

- [UND Care Team](#): 701.777.2664 (8:00 AM to 4:30 PM M-F) or 701.777.3491 (evenings and weekends)
- [UND Campus Police](#): 701.777.3491-UND Student Health: 701.777.4500
- [UND Civil Rights & Title IX Resources](#): 701.777.4171
- [Abuse and Rape Crisis Hotline \(CVIC\)](#): 701.746.8900 (24 hours)
- [Grand Forks Police Department](#): 701.787.8000 (24 hours)
- [Altru Hospital Emergency Room](#): 701.780.5280
- [UND Student Diversity and Inclusion](#): 701.777.6985
- [Food For Thought Pantry](#): (Wilkerson Commons Room 169; 701.777.4200)
- [National Suicide Prevention Lifeline](#): Dial 988

Materials - Text, Readings, & Supplementary Resources



Principles of nuclear rocket propulsion
ISBN: 978-0-323-90030-0
Authors: William J. Emrich, Jr.
Publisher: AIAA/BH
Publication Date: 2023
Edition: Second

The following are information sources on parameter values for nuclear reactions:

- Atomic weights of different isotopes:
<https://www.nist.gov/pml/atomic-weights-and-isotopic-compositions-relative-atomic-masses>
- Cross sections, half time, yields, decay data:
<https://www.nndc.bnl.gov>

Take some time to get familiar with them. You may need to extract information to work on some of the assignments proposed.

Technical Requirements & Assistance

Whether you're taking courses in the classroom or online, it's important to have the right technology and equipment. Visit the [UND Technical Requirements](#) webpage for more information. Students are expected to use their official UND

email in the course. For technical assistance, please contact [UND Technical Support](#). Visit the University Information Technologies (UIT) website for their hours, help documents, and other resources.

Visit the [Knowledge Base](#) for additional support and information about general tech requirements for students including information about devices, operating systems, software, internet connection, and major-specific tech requirements.

CircleIn

CircleIn

Starting in Fall 2026, the University of North Dakota is providing campus-wide access to CircleIn for all students over the next five years. CircleIn is a peer-to-peer learning app where students can study remotely, ask questions, collaborate with peers to exchange ideas, and stay productive. The information shared by students on CircleIn is not vetted by instructors. CircleIn facilitates a digital class community and creates the space for students to work together just like in a coffee shop or a library. Students earn points on the platform by sharing helpful resources, collaborating with classmates, and studying within the app. Those points can be redeemed for gift cards and other rewards through CircleIn. CircleIn can be accessed by clicking one of the following links: [Download CircleIn Mobile](#) or [Open CircleIn](#).

Names and Pronouns

Names and Pronouns

Everyone should feel included and respected at UND. Please let the instructor know if you wish to be addressed by a name or pronoun that is different from what appears in the class roster, including names and personal pronouns that correspond to your gender identity.

Preferred names and pronouns may change during the semester, if at any point during the semester you would like to be addressed differently, please let the instructor know.

As part of our commitment to inclusion in this course, it is important that all students in this class are respectful of their peers.

If you have experienced discrimination or harassment, please contact the [Civil Rights & Title IX Office](#) for assistance.

Land Acknowledgement

Today, the University of North Dakota rests on the ancestral lands of the Pembina and Red Lake Bands of Ojibwe and the Dakota Oyate - presently existing as composite parts of the Red Lake, Turtle Mountain, White Earth Bands, and the Dakota Tribes of Minnesota and North Dakota. We acknowledge the people who resided here for generations and recognize that the spirit of the Ojibwe and Oyate people permeate this land. As a university community, we will continue to build upon our relations with the First Nations of the State of North Dakota - the Mandan, Hidatsa, and Arikara Nation, Sisseton-Wahpeton Oyate Nation, Spirit Lake Nation, Standing Rock Sioux Tribe, and Turtle Mountain Band of Chippewa Indians.

IRB Study Information Sheet

Please Read Carefully the IRB Study Information Sheet (SIS) you will find [here](#). By default, we are collecting evidence of the work done under this IBLcourse for future studies. All information gathered will be completely anonymous.

If for any reason you do not wish to use the information generated during the course, please follow the instructions in the ARB SIS.