

Radio Waves in the Near-Earth Space Environment

EEL 5934 Section 0010

Class Periods: MWF Period 5 (11:45 am – 12:35 pm)

Location: 327 MAE-A

Academic Term: Spring 2024

Instructor:

Robert C. Moore

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352-392-0634

Office Hours: MWF 11:00 am -11:35 am, NEB 557

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

- TBD

Course Description

This course provides a general introduction to the near-Earth space environment, as revealed by experimental observations of radio and other electromagnetic waves using electric and magnetic field sensors on the ground and on space probes. It will cover the following topics: radio wave propagation through the Earth's ionosphere and magnetosphere, as well as through interplanetary space; the role of the sun in producing and supporting these environments; and naturally occurring phenomena, such as the Earth's radiation belts and the aurora.

Course Pre-Requisites / Co-Requisites

Prerequisite: An undergraduate electromagnetics course, such as EEL 3472 or equivalent.

Course Objectives

This course aims to introduce students to the complexities of the near-Earth space environment with specific application to radio wave propagation. Course material includes the typical constituents of the different regions of space and discusses the natural phenomena that regularly occur within them. Radio frequencies from the PC1 band (<1 Hz) to beyond the L-band (>1 GHz) are considered. This course will evaluate three student learning objectives: 1) the student's ability to identify, formulate and solve electrical and computer engineering problems, evaluated using a specific problem on Midterm Exam #1, 2) the student's ability to use applied mathematical techniques, evaluated using a specific homework set focused on mathematical techniques, and 3) the student's ability to use modern engineering tools for practice at an advanced level, evaluated using a computational problem set.

Materials and Supply Fees

N/A

Required Textbooks and Software

- Title: Introduction to the Space Environment
- Author: Thomas F. Tascione
- Publication date and edition: Kriegar Publishing Company, 1994, Second Edition
- ISBN number:0-89464-044-5

- Instructor-provided Course Notes

Course Schedule

Week 1: Basic Plasma Physics/Tascione Chapter 1

Week 2: Basic Solar Physics/Tascione Chapter 2

Week 3: The Solar Wind/Tascione Chapter 3

Week 4: Geomagnetism/Tascione Chapter 4

Week 5: The Earth's Magnetosphere/Tascione Chapter 5

Course Title, Prefix, and Number

Course Instructor and Academic Term

Page 1

v08/05/22

- Week 6: The Earth's Neutral Atmosphere/Tascione Chapter 6/Exam 1
- Week 7: The Earth's Ionosphere/Tascione Chapter 7
- Week 8: Natural Ionospheric Phenomena/Tascione Chapter 8
- Week 9: Radio Wave Propagation in the Ionosphere/Tascione Chapter 9
- Week 10: Refractive Index/Course Handouts
- Week 11: Dispersion/Course Handouts
- Week 12: Group Refractive Index/ Course Handouts/Exam 2
- Week 13: Polarization and Faraday Rotation/ Course Handouts
- Week 14: Slowly Varying Media/Course Handouts
- Week 15: Refraction and Ray Tracing/Course Handouts

Attendance Policy, Class Expectations, and Make-Up Policy

Excused absences must be consistent with university policies in the Graduate Catalog (<https://catalog.ufl.edu/graduate/regulations>) and require appropriate documentation. Additional information can be found here: <https://gradcatalog.ufl.edu/graduate/regulations/>

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (7)	10 each	25%
Participation	5	5%
Midterm Exams (2)	100 each	40%
Final Exam	100	30%
Total		100%

Grading Policy

This graduate course is co-listed with the undergraduate class. The homework sets for the undergraduate and graduate sections will be graded separately and on different scales. The undergraduate and graduate sections will also receive different midterm and final exams, which will also be graded on different scales.

The following is given as an example only.

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

[UF Graduate Catalog](#)
[Grades and Grading Policies](#)

Students Requiring Accommodations

Course Title, Prefix, and Number
Course Instructor and Academic Term

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.

<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.

<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/state-authorization-status/#student-complaint>.