

Course Syllabus

Course Information

<i>Course Number/Section</i>	EERF 6394-501 (Tuesday, Thursday, 5:30pm- 6:45pm, FN 2.202)
<i>Course Title</i>	Antenna Engineering and Wave Propagation
<i>Term</i>	Fall, 2022

Professor Contact Information

<i>Professor</i>	Dr. Ifana Mahbub
<i>Office Phone</i>	TBD
<i>Email Address</i>	ifana.mahbub@utdallas.edu
<i>Office Location</i>	ECSN 3.914
<i>Office Hours</i>	M/W 1:30 – 2:30 pm (or schedule meeting via email)
<i>Other Information</i>	Course TA Oscar Ferney Medina Email: oscar.medina2@utdallas.edu Please email the TA to schedule an appointment

Course Modality and Expectations

This class will be conducted in-person (face-to-face) in the regular classroom/laboratory setting.

COVID-19 Guidelines and Resources

The information contained in the following link lists the University's COVID-19 resources for students and instructors of record.

Please see <http://go.utdallas.edu/syllabus-policies>.

Course Pre-requisites, Co-requisites, and/or Other Restrictions

<i>Pre-requisites</i>	EEGR 6316 or equivalent
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Course Description

This is a graduate level antenna design course with exclusive focus on antenna theory and wave propagation. Antennas will be designed and simulated using the Ansys HFSS software and then built and measured to compare performance with the theoretical/simulation results. The class covers different aspects of antenna engineering, including:

- antenna alphabet including the near- & far-field characterization;
- theory of operation / analysis methods / design procedure for certain antenna types (wire, printed, aperture,...);
- theory, analysis and design of finite and infinite arrays;
- antennas for narrow/multi/broad-band operation;
- feeding techniques;

- numerical analysis methods for different antenna configuration.

Student Learning Objectives/Outcomes

- Ability to understand the fundamentals of radiation and radiation parameters.
- Ability to design basic antennas including linear wire antennas, loop antennas, arrays, broad band antennas, aperture antennas, horn antennas, reflector antennas, microstrip antennas, antenna arrays and phased arrays.
- Ability to develop prototypes of wire or microstrip antennas, measure their characteristics, and understand the measurements.
- Get hands-on experience with commercial full-wave electromagnetic simulation tools widely used for antenna design such as CST Microwave Studio or ANSYS HFSS.

Required Textbooks and Materials

Antenna Theory: Analysis and Design, 4th Edition, Costantine A. Balanis, Wiley
 Previous Editions of the text are also fine

Some other suggested books:

- “Antenna Engineering Handbook”, 3rd or 4th Edition, McGraw, 1993
- “Antennas for All Applications”, 3rd Edition, Kraus, McGraw, 2002
- “Antenna Theory and Design”, Stutzman, Thiele, Wiley

Suggested Course Materials

Selected articles from following sources:

- IEEE Transactions on Antennas and Propagation
- IEEE Transactions on Microwave Theory and Techniques
- IEE Proceedings Microwave Antennas and Propagation
- <https://ieeexplore.ieee.org/Xplore/guesthome.jsp>

Grading Policy

Homework	10%
Mini-projects (Simulation/Measurement)	30% (3 projects)
Mid-term I	20%
Mid-term II	20%
Final Project	20% (10% presentation +10% report)

General grading standard:

- 92.50 – 100 A
- 89.50 – 92.49 A-
- 86.50 – 89.49 B+
- 81.50 – 86.49 B
- 78.50 – 81.49 B-
- 75.50 – 78.49 C+
- 67.50 – 75.49 C
- <67.50 F

Tentative Schedule:

Date	Topics	Text Sections
Aug. 23	Introduction	1
Aug. 25	Radiation Pattern, Power Density, Graphical Solution	2.2,3 6.7
Aug. 30	Radiation Intensity, Directivity	2.4,5
Sept. 1	Gain, Efficiency, HPBW, BW	2.6-11 (Mini project 1 post) (HW 1 post)
Sept. 6	Polarization	2.12
Sept. 8	Input Impedance, Radiation Efficiency, Effective Length, Radar Range Eq., Temp.	2.13-18
Sept. 13	Vector Potential Analysis	3.2-6 (HW 2 post) (HW 1 due)
Sept. 15	Duality, Reciprocity	(Mini project 1 due)
Sept. 20	Linear Wire Antennas : Hertzian Dipole, Small Dipole	4.1-3 (HW 2 due)
Sept. 22	Near and Far Fields,	4.4 (Mini project 2 post)
Sept. 27	Finite Dipole	4.5,6
Sept. 29	Near Perfect Conductors	4.7,8
Oct. 4	Loop Antennas	5.1-3
Oct. 6	Review	(Mini project 2 due)
Oct. 11	Midterm I	
Oct. 13	Arrays	6.1-2 (Mini project 3 post)
	N-Element Arrays	6.3,4
Oct. 18	Beam Steering	6.8 (HW 3 post)
	Planar Arrays	6.10
Oct. 20	Impedance and Mutual Coupling	8.5-7
	Broad-Band Antennas	9.1-3,5,6
Oct. 25	Cylindrical and Insulated Dipoles	9.4 and instructors notes (HW 3 due) (Final Project proposal due)
	Matching Techniques	9.8
Oct. 27	Patch Antennas	14.1-2 (Mini project 3 due)
Nov. 1	Rectangular Patch	14.2 (HW 4 post) [I will be out of town, video lecture will be posted]
	Circular Patch, Input Impedance, Coupling	14.3,4, 14.5,6
Nov. 3	Polarization	14.7
	Feed Systems	14.8

Nov. 8	Antenna Synthesis	7.1-9 (Overview)
Nov. 8	Antennas Synthesis	(HW 4 due)
Nov.10	Review	
Nov.15	Midterm II	
Nov.17	Traveling Wave Antennas	10.1-2 [I will be out of town, video lecture will be posted]
Nov.29	Helix,Spiral (Overview)	10.3, 11.3
	Aperture Antennas (Overview)	12.1-5
Dec.1	Horn Antennas (Overview)	13 (Final project discussion session)
Dec.6	Corner Reflectors	15.3
	Parabolic Reflectors	15.4
Dec. 8	Final Presentation	

Course Policies

Make-up exams

Any request for change of exam schedule due to out-of-town work, religious holiday, etc. must be approved in advance. Students have two weeks to review graded homework, lab reports, quizzes, exams or projects with the professor for any possible grading corrections once the grades have been posted on eLearning. After two weeks, no changes will be allowed.

Extra Credit

No extra credit or make-up exams will be given to improve scores.

Late Work

Lab Reports and Design Projects are to be uploaded to eLearning by the assigned due date. Late submissions will be subject to an additional 10-point deduction per day.

Classroom Citizenship

All in-person exams are to be completed individually, not as a team or group.

Class Materials

The instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course, however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

Class Recordings

The instructor may record meetings of this course. These recordings will be made available to all students registered for this class if the intent is to supplement the classroom experience. If the instructor or a UTD school/department/office plans any other uses for the recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law. Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

“As a Comet, I pledge honesty, integrity, and service in all that I do.”

Academic Support Resources

The information contained in the following link lists the University’s academic support resources for all students.

Please see <http://go.utdallas.edu/academic-support-resources>.

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University’s policies and procedures segment of the course syllabus. Please review the catalog sections regarding the [credit/no credit](#) or [pass/fail](#) grading option and withdrawal from class.

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.