

South Dakota School of Mines & Technology
Antennas for Wireless Communications Lab, Spring, 2025
EE 483L-M01 (3-0) 3 credits

Instructor Information

Instructor's Name- Thomas Montoya

Instructor's Contact Information- (605) 394-1219, Thomas.Montoya@sdsmt.edu, EEP 314

Instructor Office Hours- 9-10 am MWF & 4-5 pm MF, or when available (open door policy).

As I do not always notice voicemails in a timely fashion, e-mails or in person are the preferred contact methods. Unless I am traveling or it arrives at night, I typically respond to e-mails the same day.

Course Information

Course Start/End Dates- 1/13/2025 to 5/9/2025

Course Meeting Times and Location- Th from 2-4:50 pm in EEP 338

Course Delivery Method- The course will be delivered in-person for labs. The syllabus and a link to my web page <http://montoya.sdsmt.edu> will be posted on D2L. The course web page will be used for posting assignments, solutions, etcetera. E-mail will be used to notify students of course-related information and events (**check daily**). Your first.last@Mines.sdsmt.edu address will be used for these e-mails.

Course Description

Introduction to antenna design, measurement, and theory for wireless communications including fundamental antenna concepts and parameters (directivity, gain, patterns, etc.), matching techniques, and signal propagation. Theory and design of linear, loop, and patch antennas, antenna arrays, and other commonly used antennas. Students will design, model, build, and test antenna(s). **Notes:** Students enrolled in EE 583/583L will be held to a higher standard than those enrolled in EE 483/483L.

Course Prerequisites- EE 382 Applied Electromagnetics

Course Corequisites- EE 483 or EE 583

Student Learning Outcomes

Student Outcomes (SOs)

Student Outcomes are defined in ABET's accreditation standards for engineering programs:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

Course Learning Outcomes (CLOs)

Upon completion of this course, students should demonstrate the ability to:

- A. Use EM software to design and model antennas. (SOs 1, 2, & 7)
- B. Design, build, match, and/or test commonly used antennas (e.g., linear dipole, loop, microstrip, and Yagi-Uda). (SOs 1, 2, 6, & 7)
- C. Measure important antenna parameters (e.g., impedance, reflection coefficient, VSWR, radiation pattern, ...) using modern test equipment (e.g., vector network analyzer). (SOs 1, 2, 6, & 7)

Course Topics- See course description and tentative course/lab schedule.

Course Materials

Required Textbook(s) and Materials

Antenna Theory: Analysis and Design (Fourth Edition), Balanis, Wiley, 2016, ISBN 1-118-64206-6.

Technology Equipment and Skills Needed for the Course

The course requires use of a vector network analyzer, power meter, computer and scientific calculator (capable complex number operations). Software needed/used in the course will include a pdf reader (Acrobat), D2L, MATLAB, NEC-2 (provided), and Microsoft Office. Skills required include the ability to navigate D2L and internet, upload/download files (e.g., text and pdf files), use MS Office programs, communicate via email, use MATLAB, and use Zoom (possibly).

Course Grading

Coursework

- Course instruction will be delivered in labs. Assignments will be posted to <http://montoya.sdsmt.edu>.
- Depending on enrollment, some labs/projects may be done with a partner. No groups of 3 or more.
- Guidelines for lab/project logbooks:
 - (a) Laboratory/project work should be in ink in a bound logbook unless otherwise specified.
 - (b) On cover, put a typed/word-processed label with: **EE 483L, Antennas for Wireless Communications Lab, Spring 2025, and your name(s)**. Optional- it is a good idea to put contact information on the cover or inside the front cover in case you misplace your logbook.
 - (c) Make a **Table of Contents** on the first page- include lab/project number (if applicable), description/title, date(s), and page(s) (both start and finish).
 - (d) Mistakes should be neatly crossed out, i.e., do not scribble out, use white out, etcetera.
 - (e) Use **only** the front side of pages (hard to read otherwise).
 - (f) Every page in logbook should be numbered (prefer top right-hand corner) whether used or not.
 - (g) Goal- another person should be able to duplicate the lab/work without outside references. For example, partner(s), equipment list (include description, brand & model #s), dates, block/circuit diagrams of test set-up ... should be included, as applicable. Comments, conclusions, summaries, ... are always valuable in meeting this goal, and, therefore, are expected.

- (h) Answers/measurements/solutions should be boxed or double underlined with the variables, values, and units (if any), included. Answers without applicable units are incomplete.
 - (i) Repetitive answers/measurements/solutions should be tabulated with the variables, values, and units (if any), included. Only a sample equation and solution needs to be provided.
 - (j) Leave space (~1/2") between consecutive parts of a lab.
 - (k) Writing/figures/graphs must be legible (e.g., size and neatness) → unreadable = no credit.
 - (l) Diagrams/figures/plots/graphs should be of a substantial size (e.g., 3" × 5" minimum), and may contain colors. As applicable, they should be captioned (at bottom), labeled (i.e., names / units on axes), scaled (i.e., numbers on axes), and clearly drawn. Tables should also be captioned (at top).
 - (m) Diagrams/figures/plots/graphs/tables may be done using computer software and affixed (pasted or taped) on pages in the logbook. The bottom should be oriented toward the bottom or right-hand side of the page. These items should be formatted to fit logbook pages without needing to be folded over (limited exceptions for large and/or complicated drawings/tables).
 - (n) Do **not** insert loose material or multiple pages in logbook, e.g., multiple pages stapled together.
- Guidelines for lab/project reports (hardcopy only):
- (a) Reports should be single-sided, entirely word-processed documents with pages numbered.
 - (b) Use a font size ≥ 12 points and line spacing ≥ 1.1 .
 - (c) Include: 1) cover page (similar to logbook), 2) Introduction, 3) body (broken down into subsections based on the steps in lab/project), 4) Summary & Conclusions, and 5) References (e.g., logbook, text, etcetera).
 - (d) Put calculations, results, m-files, and plots/figures in the body of the report in the order specified or as they occur. Appendices are NOT to be used as a “dumping ground” for figures and m-files. However, longer mathematical derivations may be attached as Appendices if referenced in the text of the report.
 - (e) All plots/figures/tables should be **numbered and captioned** to allow easy reference.
 - (f) Numerical results that are specifically requested should be put on separate line(s), not ‘buried’ in the middle of a paragraph.
 - (g) To enhance readability, figures/plots should span width of page and face either the bottom or right of page. Also, remember that text on figures/plots that is too small to read might as well not exist.
 - (h) On all plots, label horizontal and vertical axes, and insert a horizontal axis at 0. Put “EE 483L, Lab/Project #, your initials, date” in the title. If a plot contains more than one trace, use different line colors/types and a legend to clearly identify each trace.
 - (i) For all m-files, put filename, EE 483L, Lab/Project #, your name(s), and date in comment lines.

Attendance Policy

Attendance is required for **all** students, i.e., an individual will not get credit for a lab that they miss even if their usual partner attends/completes the lab.

Late/Make-up Assignment Policy

- Lab/project logbooks/reports are due on specified days (up to 10%/day penalty for being late without doctor’s note, etcetera). Hardcopy format only.
- Notify instructor in advance (when possible) if you will be absent from lab to make arrangements to complete lab work. Make-ups for labs **only** allowed for school-sponsored events, documented illness, etcetera.

Academic Integrity

South Dakota Mines is committed to academic honesty and scholarly integrity. The South Dakota Board of Regents ([BOR Policy 2.9.2](#)) provides a comprehensive definition of “Academic Dishonesty”, which include cheating and plagiarism. All Instructors at South Dakota Mines are required to report allegations of academic misconduct to the Student Conduct Officer. [BOR Policy 3.4.1](#) provides detailed information regarding key definitions, policy information, prohibited conduct, and the Student Conduct process adhered to at South Dakota Mines. Any student suspected of violating academic integrity standards will be reported in accordance with the process outlined on the South Dakota Mines [website](#).

- Students are encouraged to discuss homework with classmates in general terms. However, copying, plagiarism ... is not acceptable and will be penalized (e.g., grade of zero).

Grading and Assessment

Student learning is assessed by attendance/logbooks/reports related to lab/project activities/assignments. Each lab/project will be equally weighted. Attendance is required for **all** labs to pass. Every lab/project must be completed to pass.

Description	Percent
Lab/project assignments (graded out of 10 points/each, equally weighted to 100% scale)	100%

Grading Scale- 100 > A > 90, 89 > B > 80, 79 > C > 70, 69 > D > 60, F < 60.

Academic Freedom Statement

Academic Freedom is the cornerstone upon which higher education is built. Academic freedom, as defined by [BOR Policy 1.6.1](#), is fundamental to the advancement of truth, development of critical thinking, promotion of civil discourse, and contribution to the public good. Each course includes the freedom to discuss relevant matters and present various scholarly views in the classroom, as determined by the subject-matter expertise of the instructor. Students are encouraged to develop the capacity for critical thinking and to pursue the truth, debate ideas, express and evaluate their opinions, and draw conclusions. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.¹

¹*Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".*

Complaint Process

While we hope that every student has a meaningful and positive experience at South Dakota Mines, should a concern arise, students are encouraged to first attempt to resolve their concern directly with the person or office directly involved. Following that attempt, should the concern remain unresolved, students are encouraged to reach out to the Dean of Students office at DeanOfStudents@sdsmt.edu or 605.394.2416. Additionally, students may access the [online form](#) to submit their complaint, appeal, or grievance.

Grade Appeal Policy

In alignment with [BOR Policy 2.9.1](#), students who wish to appeal their final course grade shall first discuss the matter with the course instructor. If the concerns are unresolved following that discussion, students may utilize the [online form](#) to submit “Appeal – Academic” for a “Grade Dispute”.

Opportunity for All - Student Success Services and Support

Students are provided a one-stop source for information regarding all the services and supports to ensure success. Visit the [Opportunity Center](#) page to learn more.

South Dakota Board of Regents Required Syllabus Statements

The following statements may be found online in South Dakota Board of Regents Academic Affairs Council Guideline [2.7.3.A\(1\)](#):

- Freedom in Learning
- Americans with Disabilities Act
- Academic Dishonesty and Misconduct
- Acceptable Use of Technology
- Emergency Alert Communications

Electronic Devices Policy

Please silence/turn off your cell phone before lab starts. No text messaging or headphones in lab. You may use a laptop/tablet and/or calculator. No other use of any other electronic devices is allowed during lab.

Tentative Course/Lab Schedule (subject to revision).

Lab Date(s)	Activities – Assignments
0 1/23/25	Lab syllabus and expectations. Familiarization w/ lab layout.
1 1/30/25	Antenna Pattern Plotting
2 2/6/25	Introduction to Vector Network Analyzer and Calibration
3 2/13/25	Antenna Input Measurements
4 2/20/25	Rhombic Antenna Modeling
5 2/27/25	Rhombic Antenna Modeling cont.
6 3/6/25	Rhombic Antenna Input Measurements
3/13/25	Spring Break
3/20/25	Yagi-Uda Antenna Design
7 3/27/25	Yagi-Uda Antenna Design Feedback/Revisions/Corrections
8 4/3/25	Yagi-Uda Antenna Match Design
9 4/10/25	Yagi-Uda Antenna Construction & Cost
10 4/17/25	Yagi-Uda Antenna Matching
11 4/24/25	UHF Television Station Information
5/1/25	Yagi-Uda Antenna Receiving Characteristics