Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
• Submit original form and attach a course syllabus.

1. The proposal is submitted by the Department of Electrical & Computer Engineering.

2. Course prefix, number and complete title of course: ECEN 626 Antenna Theory and Technique

3. Course description (not to exceed 50 words): Applied electromagnetics and physical layer concepts for modern communication systems; topics include: advanced antenna theory and analytical techniques (e.g., variational and perturbational); full-wave tools for complex radiating structures and fading environments; reconfigurable antennas and device integration; multiple antenna techniques; and fabrication, measurement, and calibration methods.

4. Prerequisite(s): Approval of instructor

5. Is this a variable credit course? □ Yes X No If yes, from ______ to ______

6. Is this a repeatable course? □ Yes X No If yes, this course may be taken ______ times.
Will this course be repeated within the same semester? □ Yes X No

7. Has this course been taught as 489/689? □ Yes X No If yes, how many times? 9 in Spring 2007 and 7 in Spring 2008

8. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

9. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

10. Prefix Course # Title (excluding punctuation) ECEN 626 Antenna Theory & Technique

<table>
<thead>
<tr>
<th>Lect.</th>
<th>Lab</th>
<th>SCH</th>
<th>CIP and Fund Code</th>
<th>Admin. Unit</th>
<th>Acad. Year</th>
<th>FICE Code</th>
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Approval recommended by:

Head of Department Date

Chair, College Affairs Date

Dean of College Date

Submitted to Coordinating Board by:

Associate Director, Curricular Services Date

Questions regarding this form should be directed to Sandra Williams at 845-8201.
Curricular Services – 11/07
ECEN 626: ANTENNA THEORY AND TECHNIQUE

CLASS TIME/DAYS: TBD
ROOM: TBD
OFFICE HOURS: TBD
TEXT: Modern Antenna Handbook by Constantine A. Balanis

I. COURSE DESCRIPTION: Antenna Theory and Techniques will cover topics in applied electromagnetics that are focused on: advanced antenna theory including variational and perturbational modeling techniques (e.g., analytical); advanced concepts for packaging and device integration; reconfigurable antennas; multiple antenna techniques for communication systems; and fabrication/measurement techniques including error models for calibration. Note: Due to the applied nature and broad range of topics covered in this course, many theoretical considerations and fundamental concepts regarding radiation and propagation will not be fully covered – thus, this course will not serve to replace ELEN 638 (Antennas and Propagation).

II. LEARNING OBJECTIVES: The goal of this class is to provide students with hands on learning experiences (through individual and group work) with regard to the design and analysis of many different types of antennas and the techniques using single and/or multiple antennas. At the end of the course students will be able to identify the radiating mechanism and impedance characteristics for the antennas covered in class and demonstrate an intuitive understanding of the critical parameters effecting their operation. Analytical modeling techniques will be discussed as they relate to various antennas and their ability to provide accurate first order designs. Software labs will allow visualization of the electromagnetic fields, the impedance behavior, and fine tuning of the designs based on analytical techniques. This course will emphasize the importance of writing through journal-style writing assignments and the use of the scientific method and engineering principles through a meticulously-kept laboratory notebook.

III. GRADING: The weighting of coursework is delineated below.

<table>
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<th>Assignment</th>
<th>Weight</th>
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<tr>
<td>3 Lab Write-Ups and Notebook Evaluation</td>
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<tr>
<td>Homework and Literature Reviews</td>
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<tr>
<td>Final Project Paper</td>
<td>15%</td>
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<tr>
<td>Final Project Presentation</td>
<td>15%</td>
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<tr>
<td>TOTAL</td>
<td>100%</td>
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If your grade falls into one of the following ranges, you are guaranteed at least the grade indicated next to the range below.

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<th>Grade</th>
<th>Description</th>
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<td>80 - 89%</td>
<td>B</td>
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<td>70 - 79%</td>
<td>C</td>
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<td>60 - 69%</td>
<td>D</td>
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<td>Below 60%</td>
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IV. TENTATIVE COURSE TIMELINE
You are encouraged to study from both the lecture notes and the text. The timeline provides a condensed and tentative description of the material covered in class. Meeting time and classroom are TBD, but there will be a total of 2 lecture hours and 3 lab hours per week.

**General description of Topics/Labs**

Week 1 ........................................ Review of Antenna and Propagation Fundamentals

**Topics for Lab Write-Up 1 and Notebook Evaluation** ..........................................................

Lab 1 and 2 ................................ Simulation, Fabrication, Calibration, and Measurement
Week 2 ................................................. Analytical Techniques for Antennas
Week 3 .................................................. Error Models and Calibrations
Labs 3 and 4 ........................................ Microstrip Patch and TEM Horn Antenna
Week 4 .................................................. Microstrip Antennas
Week 5 .................................................. Antenna Measurement Techniques

**Topics for Lab Write-Up 2 and Notebook Evaluation** ..........................................................

Labs 5 and 6 ........................................ Slotted and Open-Ended Waveguide Antennas
Week 6 .................................................. Large Aperture Radiators
Week 7 .................................................. Frequency Independent Antennas
Labs 7 and 8 ......................................... Spiral, Lens, and Rod Antennas
Week 8 ...................................................
Week 9 .................................................. Frequency Independent Antennas

**Topics for Lab Write-Up 3 and Notebook Evaluation** ..........................................................

Labs 9 and 10 ................................. Reconfigurable Microstrip Antenna and Cellular Phone Integration
Week 10 ................................................ Reconfigurable Antennas and Mechanisms
Week 11 ................................................ Integration and Packaging
Labs 11 and 12 ................................. Diversity Gain and Propagation Channel Metrics
Week 12 ................................................ Multiple Antenna Techniques
Week 13 ................................................ Fading and Multipath
Lab 13 .................................................. High-Speed Satellite Communications (SATCOM)
Week 14 ................................................ Emerging Antenna Technologies

**Final Project Presentations will be presented and Final Project Papers will be due during the final Exam Period**

**V. Lab Write-Ups and Notebooks:** Students will be expected to maintain a laboratory notebook that documents their activities, experiments, simulations, and measurements;
these will be signed by the TA and lab partner at the end of each lab section. Laboratory write-ups (5-10 typed pages including plots, pictures, etc.) and laboratory notebooks (including data, plots, activities, etc.) will be collected and graded three times throughout the semester according to the course topics set for these sections.

**VI. Literature reviews:** Bi-weekly literature reviews in this class are taken from both past and present peer reviewed journal articles that have demonstrated a significant impact in the field of antenna engineering. Reviewing and discussing these papers will provide graduate students with the opportunity to exercise the critical thinking skills that are necessary for independent research and to serve as a metric for the development of the field and a survey of the current state-of-the-art. These reviews will stagger homework assignments, and will be discussed/debated in class. A short synopsis (1-2 typed pages) discussing the impact of the assigned papers on technology, the state-of-the-art, and potential applications will be due by the beginning of the class when the next literature review is to be assigned.

**VII. Homework Assignments:** Weekly pre-lab homework assignments will include analytical work to provide the foundation for the design and analysis of the antennas covered in class. Software exercises will also be included in homework to familiarize the student with the software packages to make the labs and projects more manageable. Group work will be encouraged in these exercises.

**VIII. Final Project Paper:** The final project paper will allow students to research an emerging topic (provide a detailed overview, state of the art, etc.) in applied electromagnetics as related to the course and write a 3 page paper in the IEEE format found at:

**IX. Final Project Presentation:** The final project presentation will allow students to prepare PowerPoint slides and present the summary of their research activities in the final project paper in the common IEEE format of a 15 min. presentation and 5 min. Q&A.

**X. Late Work:** Late assignments will not be accepted for full credit after their posted due date. You may submit late assignments until 4:00pm the next day for 50% credit and until 4:00pm the second late day for 25% credit. Assignments received after 4:00pm on the third late day will be returned un-graded.

**XI. ADA Policy Statement:** The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe that you have a disability requiring accommodation, please contact the Department of Student Life Services for Students with Disabilities in Room B118 Cain Hall promptly at the beginning of the semester. The phone number of this office is 845-1637.
XII. CVM COURSE EVALUATION
All students are expected and requested to complete the CVM Course Evaluation Form on the website near the end of each semester. Students will be notified by e-mail and in class when the Evaluation Forms are to be completed.

XVIII. ACADEMIC INTEGRITY STATEMENT

"AN AGGIE DOES NOT LIE, CHEAT, OR STEAL OR TOLERATE THOSE WHO DO."

Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the processes of the Honor System.