COLORADO STATE UNIVERSITY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 444 – *Antennas & Radiation*, Fall 2023

<u>COURSE SYLLABUS</u>

(1) <u>Course Details:</u>

<u>Instructor:</u> **BRANISLAV M. NOTAROS**, Professor, Engineering C101C, Phone: (970) 491-3537

E-mail: notaros@colostate.edu, Web: www.engr.colostate.edu/~notaros

<u>Class Meetings:</u>   Tuesday, Thursday 9:30am–10:45am, Stadium 1214

<u>Office Hours:</u> Tuesday 11:00am-12:00noon and Thursday 11:00am-12:00noon, or by appointment

<u>Textbook:</u> **-** *Electromagnetics*, Branislav M. Notaros, PEARSON Prentice Hall

- *Companion Website* for the book: www.pearsonhighered.com/notaros
    MATLAB Exercises and Projects
    Conceptual Questions
- *Notes provided by the instructor*

<u>Additional References:</u>

- *Antenna Theory and Design*, Second Edition, Warren L. Stutzman and Gary A. Thiele, John Wiley & Sons, 1998.
- *Antenna Theory: Analysis and Design*, Constantine A. Balanis, Second Edition, John Wiley & Sons, 1997.
- *Antennas for All Applications*, Third Edition, John D. Kraus and Ronald J. Marhefka, McGraw Hill, 2002.

<u>Class Web Page:</u>   Canvas

(2) <u>Course Description:</u>

Antenna fundamentals, antenna arrays, and basic types of antennas for wireless communication. Electromagnetic theory is first reviewed. Mathematical solution of Maxwell's equations for radiation problems is introduced. Basic antenna parameters are defined and discussed. Electrically small antennas are analyzed. Theory of receiving antennas is presented. Topics in antenna arrays include the array factor, pattern multiplication, multidimensional arrays, phased arrays, and smart antennas. Several types of antennas are studied, including wire, microstrip, and aperture antennas. Concepts, tools, and practice of antenna analysis, measurement, and design are introduced.

<u>Course also includes:</u>

- MATLAB tutorials, exercises, and projects in antennas and wireless communication systems
- Antenna analysis and design simulation sessions and projects using WIPL-D software

(3) <u>Homework:</u>

- Homework will be assigned weekly, roughly. Homework assignments will be posted on Canvas.

- Homework will be due at the specified time (typically the following week) as online submission in Canvas. Late homework is not allowed and will not be collected.

- The solutions to homework problems will be posted on Canvas.

(4) **Evaluation of Students and Grading Policy:**

- Homework and projects (30%)
- Exam 1 (20%)
- Exam 2 (20%)
- Final Exam (30%)

Grades will be assigned from A+ through F, including plus and minus categories (no C-, D+, and D-), according to the following grading rubric:
$97 \le x \le 100$ A+; $93 \le x < 97$ A; $90 \le x < 93$ A-; $87 \le x < 90$ B+; $83 \le x < 87$ B; $80 \le x < 83$ B-; $77 \le x < 80$ C+; $70 \le x < 77$ C; $60 \le x < 70$ D; $x < 60$ F;

(5) **Exams:**

- Exam 1 – Tuesday, October 24, 2023
- Exam 2 – Thursday, November 30, 2023
- Final Exam – see the Fall 2023 Final Exam Schedule on the CSU web

All exams are closed book, closed notes. One sheet with formulas (prepared by the student) is allowed per each partial exam, and two sheets for the final exam.

(6) **Academic Integrity Policy:**

- This course will adhere to the CSU Academic Integrity Policy as found in the General Catalog (http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf) and the Student Conduct Code (http://www.conflictresolution.colostate.edu/conduct-code). At a minimum, violations will result in a grading penalty in this course and a report to the Office of Conflict Resolution and Student Conduct Services.

(7) **Organization of Course Topics:**

	No.of Weeks (tentative)
1. Electromagnetic fundamentals	1
2. Antenna and radiation fundamentals and definitions	1
3. Theory and applications of transmitting antennas	2
4. Theory and applications of receiving antennas	1
5. Wireless communication systems	1
6. Radar cross section and radar equation	1
7. Analysis and synthesis of antenna arrays	3
8. Resonant wire and patch antennas and arrays	2
9. Fundamentals of broadband and aperture antennas	1
10. Antenna analysis, measurements, and design	2

(8) **Course Objectives/Outcomes:**

Please see the ECE444 IO Diagram (attached):

http://www.engr.colostate.edu/ece/IO_diagrams/ECE444_final.pdf