COLORADO STATE UNIVERSITY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 541 – *Applied Electromagnetics*, Fall 2023

COURSE SYLLABUS

(1) Course Details:

Instructor: **BRANISLAV M. NOTAROS**, Professor, Eng C101C, Phone: (970) 491-3537
E-mail: notaros@colostate.edu, Web: www.engr.colostate.edu/~notaros

Class Meetings: Tuesday, Thursday 12:30–1:45 pm, Engineering B 105

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

Textbook: Required: TBD
Optional: *Electromagnetics*, Branislav M. Notaros, PEARSON Prentice Hall, 2010
- Lecture notes provided by the instructor.

(2) Course Description:

High- and low-frequency electromagnetics, wave propagation, radiation, and scattering, wireless and guided-wave systems, bioelectromagnetics

This ECE graduate electromagnetics course provides students with advanced electromagnetics concepts and in-depth understanding and analytical skills in applied engineering electromagnetics to effectively solve complex practical electromagnetic problems. The course serves students interested in electromagnetics, RF, radar, remote sensing, lasers and optics, circuits, communication, systems, and power areas.

(3) Specific Course Topics (tentative):

1. Maxwell's equations in integral and differential forms, Boundary conditions, Materials
2. General theory of transmission lines and waveguides
3. Field analysis of multiconductor and multi-trace transmission lines, arbitrary cross section, lossy conductors and dielectrics
4. Analytical and computational methods and tools for analysis and design of multiconductor lines and interconnects
5. Electrostatic analysis of multiconductor systems, Matrix capacitances, Applications to high-frequency and high-speed structures and circuits
6. Circuit analysis of multiconductor transmission lines in frequency domain, from matrix circuit parameters to complex signals
7. Transient analysis of multi-conductor transmission lines, Printed lines, Crosstalk, Signal integrity
8. Modal analysis of waveguides and cavity resonators
9. Electromagnetic potentials, Lorenz gauge, High-frequency potentials in time and frequency domains
10. High- and low- frequency electromagnetics, Limitations of circuit theory
11. General scattering theory for arbitrary objects, Analytical and computational methodologies and tools

12. Analytical techniques for scattering computation in cylindrical and spherical coordinate systems
13. Radar cross section of metallic/dielectric objects, Rayleigh scattering, Mie solution, optical region
14. Bioelectromagnetics, biomedical applications of EM fields/waves at RF and microwave frequencies

(4) Evaluation of Students and Grading Policy:

- The class consists of multiple (typically 6-8) class projects/assignments covering respective course topics or groups of topics.
- The class grade (100%) is generated based on the grades of the class projects/assignments.
- There are no exams.

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

(5) 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.

(6) Course Learning Objectives:

1. Analyze and evaluate low-frequency electromagnetic fields
2. Analyze and evaluate high-frequency electromagnetic fields
3. Analyze and evaluate electromagnetic propagation, radiation, and scattering
4. Analyze, evaluate, and design wireless and guided electromagnetic wave systems