COLORADO STATE UNIVERSITY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 541 – *Applied Electromagnetics*, Fall 2020

<u>COURSE SYLLABUS</u>

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

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

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

<u>Class Meetings:</u> Tuesday, Thursday 12:30–1:45 pm, online

<u>Office Hours:</u> Tuesday 2:00-3:00pm and Thursday 2:00-3:00pm online, or by appointment

<u>Textbook:</u> Required: TBD
Optional: *Electromagnetics*, Branislav M. Notaros, PEARSON Prentice Hall, 2010

- Lecture notes provided by the instructor.

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

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) <u>Specific Course Topics/Units/Weekly Schedule (tentative):</u>

1. Maxwell's equations in integral and differential forms, Boundary conditions, Materials
2. Electromagnetic potentials, Lorenz gauge, High-frequency potentials in time and frequency domains
3. High- and low- frequency electromagnetics, Limitations of circuit theory
4. Impressed sources, Energy and Power, Generalized Poynting's theorem for any materials and sources
5. Equivalent electric and magnetic currents, Electromagnetic field theorems, applications
6. Electrostatic analysis of multi-conductor systems, Matrix capacitances, applications
7. General theory of transmission lines and waveguides
8. Multilayer printed circuit board, Microstrip and strip lines including fringing effects
9. Frequency-domain analysis of multi-conductor transmission lines
10. Transient analysis of multi-conductor transmission lines, Printed lines, Crosstalk, Signal integrity
11. Computational methods and tools for analysis and design of multi-conductor lines and interconnects
12. Modal analysis of waveguides, Metallic waveguides, Dielectric waveguides
13. Electromagnetic resonators, Transmission-line resonators, Waveguide cavity resonators
14. Electromagnetic scattering, Rayleigh scattering, Mie solution, high-frequency scattering

15. Bioelectromagnetics, biomedical applications of EM fields/waves at RF and microwave frequencies

(4) Evaluation of Students and Grading Policy:

- Homework and projects (40%)
- Midterm Exam (20%)
- Final Exam (40%)

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) Exams:

- Midterm Exam – Tuesday, October 13, 2020
- Final Exam – see the Fall 2020 Final Exam Schedule on the CSU web

(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) 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