COLORADO STATE UNIVERSITY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 540 – Computational Electromagnetics, Spring 2017

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 PM – 1:45 PM, Engineering B 2

Office Hours: Tuesday 2 pm – 3 pm, Thursday 2 pm – 3 pm, or by appointment

- Lecture notes provided by the instructor.

Reference Texts:

(2) Course Description:

Computational techniques for practical applications in electromagnetic fields, devices, scattering, propagation, and radiation. The course reviews the electromagnetic (EM) theory, static and dynamic fields, Maxwell’s equations, boundary conditions, wave equations, Lorentz potentials, Green’s functions, and basic EM-field theorems. Most popular classes of computational EM methods based on differential and integral equations are studied. Solution techniques include the method of moments, finite difference method, finite element method, physical optics, and hybrid methods. Applications cover static and quasi-static problems, transmission lines, wireless propagation, scattering, radiation problems, EM compatibility, and signal integrity. The course includes about 10 computational EM projects in different techniques and different applications, using MATLAB.
(3) **Evaluation of Students and Grading Policy:**
- Homework and projects (~60%)
- Midterm Exam (~20%)
- Final Exam (~20%)

Grades will be assigned from A+ through F, including plus and minus categories (no C-, D+, and D-), according to the following grading rubric:

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\begin{align*}
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;
\end{align*}
\]

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

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<tr>
<th>No. of Weeks (tentative)</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>1. Review of Electromagnetic Theory</td>
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<td>2. Analytical Techniques</td>
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<td>3. Surface Integral-Equation Techniques and Method of Moments</td>
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<td>4. Volume Integral-Equation Techniques</td>
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<td>5. Analysis of Wire Antennas and Scatterers</td>
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<td>6. Finite-Difference Techniques</td>
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<td>7. Finite-Element Techniques</td>
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<td>8. High-Frequency Asymptotic Techniques</td>
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<td>9. Hybrid Techniques</td>
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<td>10. Multi-Conductor Transmission Lines and Signal Integrity</td>
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(5) **Course Objectives/Outcomes:**

This course will be suitable for graduate students in Electrical and Computer Engineering as an introductory level course for the technical areas of applied electromagnetics, radar, remote sensing, electronic devices, and lasers and optics. The learning objectives of the course can be summarized as follows:

- The course will provide students with an overview of the state-of-the-art in applied computational electromagnetics, covering analytical, numerical, and asymptotic techniques for solving complex electromagnetic problems.
- Students will develop computational skills in applied electromagnetics and related disciplines and ability not only to effectively use electromagnetic software, but also to understand the foundations of various codes.
- The course will expose students to examples of real-world applications of modern computational tools in electromagnetic scattering, propagation, and radiation.
- The course will enable students to identify interesting and important research topics for Master’s and Ph.D. work.