Course Syllabus

ELCT 350 – Computer Modeling of Electrical Systems

Course Coordinator: Undergraduate Program Committee

Catalog Description: Formulation of physics-based dynamic models of electrical or electromechanical systems. Solving dynamic equations of electrical systems in discrete time. Use of object oriented programming language (e.g., C++) and computer tools (e.g., MATLAB, virtual test bed) for solving dynamic equations of electrical systems.

Credit Hours 3

Prerequisite(s) by course CSCE 145 and ELCT 222

Prerequisite by topics Signals, Convolution, Differential Equation, Laplace transform, Z-transform, Fourier series, Basic MATLAB commands, Computer Organization, Microprocessor, Arithmetic

Required Textbook None

Other Materials Class notes posted on Blackboard

Learning Outcomes:

Students who successfully complete the course will be able to:

1. formulate a physics-based dynamic model of an electrical or electromechanical system.
2. apply numerical integration to solve a set of dynamic equations in discrete time.
3. identify the most suitable modeling approach according to simulation objectives.
4. use object oriented programming language (C++) to implement the solution to a set of equations.
5. develop models from physics-based equations and to implement these models in reusable form by using object oriented programming language (C++)
6. identify and use good software engineering practices in the implementation of modeling and simulation programs.
7. use simulation tools and understand their structures (MATLAB, VTB).

Course Topics:

- Introduction to Circuit Simulation
- Linear DC Nodal Analysis
- Solution of Linear Equations
- Linear Transient Analysis
- State Space formulation of dynamic circuit
- Signal flow representation of dynamic circuit
- From State Space representation to Laplace representation
- C++ Programming for Circuit Simulation
- Using simulation tools: Matlab, VTB

Course Contribution to Program Outcomes:

ELCT 350 contributes to an achievement of:

- Outcome 1 – an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- Outcome 6 – an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusion
- Outcome 7 – an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
General Course Policies

Academic Integrity
Unless otherwise stated, assignments and examination work are expected to be the sole effort of the student submitting the work. Students are expected to follow the University of South Carolina Honor Code and they should expect that every instance of a suspected violation will be reported. Students found responsible for violations of the Code will be subject to academic penalties under the Code in addition to whatever disciplinary sanctions are applied.

Accommodating Disabilities
Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, contact the Office of Student Disability Services: 777-6142, TDD 777-6744, email sasds@mailbox.sc.edu, or stop by LeConte College Room 112A. All accommodations must be approved through the Office of Student Disability Services.

Diversity
When scheduling exams, I have attempted to avoid conflicts with major religious holidays. If, however, I have inadvertently scheduled an exam or major deadline that creates a conflict with your religious observances, please let me know as soon as possible so that we can make other arrangements.

Recommended Study Habits
- Read the assigned material before class.
- Bring thoughtful questions to class for discussion.
- Prepare for the exams in study groups.
- Take notes during class discussions and while completing reading assignments.

Deviations
Minor deviations from the syllabus are a normal part of any adaptive teaching and learning process.
Instructor’s Addendum for Fall 2018

Instructor: Dr. Andrea Benigni  Phone: 803.777.3390
Office: Swearingen 3A18 Office hours: anytime I am in the office or by appointment
E-mail: benignia@cec.sc.edu  Class Meeting Time: MWF 12:00 – 12:50 PM

Course Delivery Structure:
Lectures

Course Assessment
2 Tests (2 x 25% each), Final Exam (30 %), HW (20 %)

Semester Average (S.A.) =

\[ \frac{0.25 \times \text{Test1Grade} + 0.25 \times \text{Test2Grade} + 0.20 \times M \times \text{HWAverageGrade} + 0.30 \times \text{FinalExamGrade}}{ } \]

\[ M = \begin{cases} 0 & \text{Partial Completion of HW} \\ 1 & \text{All HW attempted and turned in} \end{cases} \]

Homework submitted on or before the due date will be eligible to earn full credit. Homework turned in after the due date will be eligible to earn up to only half credit (delay must be approved by instructor on the day homework are assigned). Note that the “M” coefficient in the grading scheme means that you must turn in ALL Homework in order to earn Homework credit.

<table>
<thead>
<tr>
<th>Final Grade</th>
<th>Semester Average</th>
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<tbody>
<tr>
<td>A</td>
<td>100 ≥ S.A. ≥ 91</td>
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<tr>
<td>B+</td>
<td>90 ≥ S.A. ≥ 86</td>
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<tr>
<td>B</td>
<td>85 ≥ S.A. ≥ 81</td>
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<tr>
<td>C+</td>
<td>80 ≥ S.A. ≥ 76</td>
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<tr>
<td>C</td>
<td>75 ≥ S.A. ≥ 71</td>
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<tr>
<td>D+</td>
<td>70 ≥ S.A. ≥ 66</td>
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<tr>
<td>D</td>
<td>65 ≥ S.A. ≥ 61</td>
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<tr>
<td>F</td>
<td>60 ≥ S.A. ≥ 00</td>
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Course Outline/Schedule
Topics for each class meeting are listed below. However, circumstances may call for a departure from this schedule. Any changes to the schedule will be made in advance. Homework assignments will be handed out at least one week prior to the due date.

Schedule Spring 2018

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Integration Methods Review</td>
</tr>
<tr>
<td>2</td>
<td>Linear DC Nodal Analysis</td>
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<tr>
<td>3</td>
<td>Solution of Linear Circuits</td>
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<tr>
<td>4</td>
<td>Numerical Methods for the Solution of Linear Systems</td>
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<tr>
<td>5</td>
<td>Modified Nodal Analysis</td>
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<td>6</td>
<td>Controlled Sources (Test 1)</td>
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<tr>
<td>7</td>
<td>Linear Transient Analysis: Resistive Companion Method</td>
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<tr>
<td>8</td>
<td>Resistive Companion Solver in C++</td>
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<tr>
<td>9</td>
<td>State Space Modeling</td>
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<tr>
<td>10</td>
<td>Solution of state space models (Test 2)</td>
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<tr>
<td>11</td>
<td>Signal Solver in C++</td>
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<tr>
<td>12</td>
<td>Hybrid Simulation in C++</td>
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<tr>
<td>13</td>
<td>Simulation to support engineering design</td>
</tr>
<tr>
<td>14</td>
<td>Simulation to support engineering design</td>
</tr>
</tbody>
</table>
Instructor Policies

Attendance Policy
Students are expected to attend each scheduled class meeting, to be on time, and to be prepared for each class session.

When you miss class, you miss important information. If you are absent, you are responsible for learning material covered in class. If you are absent when an assignment is due, you must have submitted the assignment prior to the due date to receive credit. If you miss more than 10% of the classes, whether excused or unexcused, your grade may be dropped one letter grade.

Expectations for Classroom Behavior
Please be respectful of each other, the instructor, and any guest presenters while in class. We are all here to learn! Any disrespectful or disruptive behavior may result in your referral to the Office of Student Judicial Programs.

Assignment Submission
Assignments are always due before class starts on the day noted. Late assignments will be accepted only in cases of emergency.

Midterm and Final Exams
Makeup exams will be allowed only with pre-approval of the instructor or with an acceptable, documented reason. Acceptable reasons for makeup exams include severe illness, family emergencies or other unavoidable events including dangerous weather conditions and car accidents. Exam format for makeup exams may be different than the original exam.

Expectations of the Instructor
I understand that students expect me to facilitate their learning, to answer their questions appropriately, to be fair and objective in grading, to provide timely and useful feedback on assignments, to maintain adequate office hours, and to treat them as I would like to be treated in their place.