Introduction to Analog Systems and Circuits for Transfer Students Lecture

ECE 2021

Course Description:
Lecture-only component of ECE 2020, for transfer students. Circuit theory and applications of passive components and Op amps. Introduction to analog systems using differential equations and Laplace transforms.

Course Goals / Objectives:
Master circuit concepts such as voltage, current, charge, resistors, inductors, capacitors, etc.
Master how to analyze and design circuits using Ohm's Law, Kirchhoff's laws and superposition
Be competent in Phasor Domain sinusoidal techniques
Be competent in analyzing and designing steady state and transient behavior of RC, RL, RLC circuits
Be competent in Laplace Transform techniques
Be competent in analyzing and designing simple active filters based on ideal Op amps
Course Topics:

- Fundamentals of electric circuits: Charge, Voltage, Kirchhoff’s Laws, power and sign conventions, Ohm's law, practical circuit elements
- Circuit Analysis Techniques: Node Voltage / Mesh analysis, superposition, Thevenin and Norton equivalents
- Ideal op amp, feedback, active filters, cascaded active filters
- RC and RL first-order circuits, natural and total response, RC Op amp circuits
- Initial and Final Conditions, Series and Parallel RLC, General solution of second-order circuits
- Laplace transforms, properties, pole – zero diagrams and inverse Laplace transform
- System transfer function – scaling, impulse response, step response, sinusoidal response, s-Domain circuit analysis
- Sinusoidal signals, Phasor domain analysis, impedance transformations
- RC, RL, RLC frequency response vs transient response
- Bode Plots, Passive and Active Filters
- Periodic Waveforms, Average and Complex Power, Maximum power Transfer

Grades Breakdown:

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm Exam 1</td>
<td>25%</td>
</tr>
<tr>
<td>Midterm Exam 2</td>
<td>25%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
</tr>
</tbody>
</table>

Designation:
- Elective
- Required
Instruction Modes:
In Person (75-100% campus; 0-24% online)
Hybrid Class (25-74% campus; 25-74% online)

Representative Textbooks and Other Course Materials:

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuits</td>
<td>Ulaby and Maharbiz</td>
<td></td>
</tr>
</tbody>
</table>