Introduction to Analog Systems and Circuits

ECE 2020

Description / Conditions

Transcript Abbreviation:
Anlg Sys & Circuit

Course Description:
Circuit theory and applications of passive components and Op amps. Introduction to analog systems using differential equations and Laplace transforms.

Course Levels:
Undergraduate (1000-5000 level)

Designation:
Required
Elective

General Education Course:
(N/A)

Cross-Listings:
(N/A)

Course Detail

Credit Hours (Minimum if “Range”selected):
3.00

Max Credit Hours:
(N/A)
Select if Repeatable: Off

Maximum Repeatable Credits: (N/A)

Total Completions Allowed: (N/A)

Allow Multiple Enrollments in Term: No

Course Length:
14 weeks (autumn or spring)
12 weeks (summer only)

Off Campus: Never

Campus Location:
Columbus
Lima
Marion

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

Prerequisites and Co-requisites:
Prereq: Math 1152, 1161.01, 1161.02, 1172, or 1181H; and Physics 1250, 1250H, or 1260, or CHEM 1210 or 1250.

Electronically Enforced: Yes

Exclusions:
Not open to students with credit for 2100, 2100.02, 2100.06, 2100.07, 2100.08, 2105, 2106, 2110, 2127, 2137, 2300, or 2360.

Course Goals and Learning Objectives
**Course Goals / Objectives:**
Master circuit concepts such as voltage, current, charge, resistors, inductors, capacitors, etc.
Master how to analyze, design and implement circuits using Ohm's Law, Kirchhoff's laws and superposition
Be competent in Phasor Domain sinusoidal techniques
Be competent in analyzing, designing and implementing steady state and transient behavior of RC, RL, RLC circuits
Be competent in Laplace Transform techniques
Be competent in analyzing, designing and implementing simple active filters based on ideal Op Amps
Be familiar with how to use modern computer tools for analog simulation
Be competent in how to use laboratory instruments and laboratory methodology
Be competent with methodology for critical troubleshooting skills

**Check if concurrence sought:**
No

**Contact Hours**
### Contact Hours:

<table>
<thead>
<tr>
<th>Topic</th>
<th>LEC</th>
<th>REC out-of-class</th>
<th>REC in-class</th>
<th>Weekly LAB out-of-class</th>
<th>Weekly LAB in-class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamentals of electric circuits: Charge, Voltage, Kirchhoff's Laws, power and sign conventions, Ohm's law, practical circuit elements</td>
<td>2.5</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Circuit Analysis Techniques: Node Voltage / Mesh analysis, superposition, Thevenin and Norton equivalents</td>
<td>4.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
</tr>
<tr>
<td>Ideal op amp, feedback, active filters, cascaded active filters</td>
<td>2.5</td>
<td>0.0</td>
<td>0</td>
<td>3.0</td>
<td>0</td>
</tr>
<tr>
<td>RC and RL first-order circuits, natural and total response, RC Op amp circuits</td>
<td>2.5</td>
<td>0.0</td>
<td>0</td>
<td>3.0</td>
<td>0</td>
</tr>
<tr>
<td>Initial and Final Conditions, Series and Parallel RLC, General solution of second-order circuits</td>
<td>2.5</td>
<td>0.0</td>
<td>0</td>
<td>3.0</td>
<td>0</td>
</tr>
<tr>
<td>Laplace transforms, properties, pole – zero diagrams and inverse Laplace transform</td>
<td>3.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
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<tr>
<td>System transfer function – scaling, impulse response, step response, sinusoidal response, s-Domain circuit analysis</td>
<td>2.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
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<tr>
<td>Sinusoidal signals, Phasor domain analysis, impedance transformations</td>
<td>4.0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
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<tr>
<td>RC, RL, RLC frequency response vs transient response</td>
<td>2.0</td>
<td>0.0</td>
<td>0</td>
<td>3.0</td>
<td>0</td>
</tr>
<tr>
<td>Bode Plots, Passive and Active Filters</td>
<td>4.0</td>
<td>0.0</td>
<td>0</td>
<td>3.0</td>
<td>0</td>
</tr>
<tr>
<td>Periodic Waveforms, Average and Complex Power, Maximum power Transfer</td>
<td>2.5</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
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<tr>
<td>Simulated circuit analysis</td>
<td>0.0</td>
<td>0.0</td>
<td>0</td>
<td>3.0</td>
<td>0</td>
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</tbody>
</table>
### Introduction to Analog Systems and Circuits - 5/6

#### Grading and Texts

**Grading Plan:**
Letter Grade

**Course Components:**
Lecture
Recitation
Lab

**Grade Roster Component:**
Lecture

**Credit by Exam (EM):**
No

**Grades Breakdown:**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Percent</th>
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<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
</tr>
<tr>
<td>Midterm Exam 1</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm Exam 2</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25%</td>
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<tr>
<td>Lab Results</td>
<td>20%</td>
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Representative Textbooks and Other Course Materials:

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

ABET Student Learning Outcomes

ABET-CAC Criterion 3 Outcomes:
(N/A)

ABET-ETAC Criterion 3 Outcomes:
(N/A)

ABET-EAC Criterion 3 Outcomes:

<table>
<thead>
<tr>
<th>Significant contribution (7+ hours)</th>
<th>1</th>
<th>an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some contribution (1-2 hours)</td>
<td>5</td>
<td>an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives</td>
</tr>
<tr>
<td>Some contribution (1-2 hours)</td>
<td>6</td>
<td>an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions</td>
</tr>
<tr>
<td>Some contribution (1-2 hours)</td>
<td>7</td>
<td>an ability to acquire and apply new knowledge as needed, using appropriate learning strategies</td>
</tr>
</tbody>
</table>

Embedded Literacies (UG courses only)

Embedded Literacies Info:

Attachments / Additional Notes or Comments

Attachments:
(N/A)

Additional Notes or Comments:
(N/A)