ELEC2400 Electronic Circuits Spring 2022-23

Course Description

Fundamental electronic concepts for DC and AC circuits, KVL and KCL, Thevenin's and Norton's theorems, linearity and superposition, nodal and mesh analyses, sinusoidal steady state and phasor representation, frequency response, transfer functions and Bode plots, op amps, first-order transient analysis, and diode circuits.

Credits: 4

Exclusion(s): ELEC 2420. *Prerequisite(s):* ELEC 1100 AND (MATH 1003 OR MATH 1014 OR MATH 1020 OR MATH 1024). *Corequisite(s):* PHYS 1114 OR PHYS 1314.

List of Topics

Week 1 Fundamental Concepts
Introduction, charge, current, voltage, circuit modeling, lumped parameter model, Ohm's law.

Week 2 Basic Circuit Theorems
Two-terminal elements, reference direction, electric power, voltage and current sources, dependent sources, active and passive elements, circuit terminology, KCL, KVL.

Week 3 DC Analysis
Series/parallel connections, voltage/current dividers, nodal/mesh analyses, linearity, superposition.

Week 4 DC Equivalent Circuits
Thevenin's and Norton's theorems, source transformation.

Week 5 Op Amp
Ideal op amp, voltage buffer, non-inverting amp, inverting amp, adder, difference amp, instrumentation amp.

Week 6 Op Amp
Current source, negative impedance converter, V-to-I converter, ADC, DAC, differentiator, integrator.

Week 7 AC Circuits
Capacitor and inductor, sinusoidal excitation, steady-state and transient responses, complex number, phasor representation.

Week 8 AC Circuit Analysis
Magnitude and phase of steady-state response, impedance, AC power.

Week 9 Frequency Response
Transfer function, poles and zeros.

Week 10 Frequency Response
Bode plots, low-, band-, and high-pass filters, first and second order systems.

Week 11 Transient Analysis
Transient circuits, switch operations.

Week 12 Transient Analysis and Diode Circuits
First-order transient response, diode models, clipping and clamping circuits.

Week 13 Diode Circuits
Half & full-wave rectifiers, Zener diode, regulator, charge pump.

Lab Topics

1. Instrumentation
2. Pspice
3. Auto-tracking Vehicle (Digital Control)
4. Auto-tracking Vehicle (Analog Control)
5. Audio Equalizer

Grading Scheme

Lab Reports	20% (4% x 5)
Homework	10% (2% x 5)
Mid-Term Examination	25%
Final Examination	45%

Textbook(s)

No required textbook

Reference Books/Materials

D. V. Kerns and J. D. Irwin, Essentials of Electrical and Computer Engineering, Pearson, 2004.
J. D. Irwin and D. V. Kerns, Introduction to Electrical Engineering, Prentice Hall, 1995.
R. J. Smith and R.C. Dorf, Circuits, Devices and Systems, Wiley, 5th edition, 1992.

Statement of Objectives/Outcomes

On successful completion of this course, students will be able to:

CO1: Apply the fundamental circuit concepts to compute the output of basic electronic circuits in response to a DC input signal.
CO2: Recognize sinusoidal steady state characteristics of basic electronic circuits using phasors and compute the output of basic electronic circuits in response to an AC input.
CO3: Compute the transient responses of basic electronic circuits consisting of capacitors and inductors.
CO4: Compute the characteristics of basic electronic circuits consisting of operational amplifiers and diodes.
CO5: Employ electronic instruments and perform experiments.
CO6: Apply CAD tools to simulate and analyze electronic circuits.

Relationship of Course to Program Outcomes

PO1: An ability to apply knowledge of mathematics, science, and electronic and computer engineering. (CO1, CO2, CO3, CO4)
PO2: An ability to design and conduct experiments, as well as to analyze and interpret data. (CO5)
PO3: An ability to design efficient and economical electronic and computer engineering systems, components, or process subject to practical constraints.
PO4: An ability to function in a multi-disciplinary environment through teamwork.
PO5: An ability to identify, formulate and solve electronic and computer engineering problems. (CO1, CO2, CO3, CO4)
PO6: An ability to understand professional practices and ethical responsibilities.
PO7: An ability to communicate effectively.
PO8: An ability to understand contemporary global, regional, economic, environmental, and social issues, and the corresponding role and the impact of electronic and computer engineers.

PO9: An ability to recognize the need for, and to engage in life-long learning.

PO10: An ability to use current techniques, skills, and engineering tools necessary for solving electronic and computer engineering problems. (CO6)

PO11: An ability to use the computer/IT tools relevant to the electronic and computer engineering along with an understanding of their processes and limitations. (CO6)