The Hong Kong University of Science and Technology

UG Course Syllabus

Electronic Circuits

ELEC2400

4 Credits

Exclusion(s): ELEC 2410 (prior to 2016-17), 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.

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Course Description

Fundamental electronic concepts for DC and AC circuits, KVL and KCL, Thevenin and Norton theorems, linearity and superposition, nodal and mesh analyses, sinusoidal steady state and phasor, transient analysis, transfer functions and Bode plots, op-amps, diodes, MOS transistors and related circuits.

List of Topics

Lecture Topics

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

Week 2: Basic Circuit Theorems
Two-terminal element, 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 plot, low-pass and high-pass filters, first and second order systems

Week 11: Transient Analysis
Transient circuits, switch operations

Week 12: Transient Analysis and Diode Circuit
First order transient response, diode models, clipping and clamping circuits

Week 13: Diode Circuit
Half & full-wave rectifiers, Zener diode, regulator, voltage doubler

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

On successful completion of this course, students will learn how to:
1. Apply the fundamental circuit concepts to compute the output of basic electronic circuits in response to a DC input signal.
2. 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.
3. Compute the transient responses of basic electronic circuits consisting of capacitors and inductors.
4. Compute the characteristics of basic electronic circuits consisting of operational amplifiers and diodes.
5. Employ electronic instruments and perform experiments. CO6: Apply CAD tools to simulate and analyze electronic circuits.

Assessments:

Assessment Task	Contribution to Overall Course grade (%)
Lab reports	20% (4% × 5)
Homework	10% (2% × 5)
Mid-term	25%
Final examination	45%

Required Texts and Materials

No required textbooks.

Reference books:
1. D. V. Kerns and J. D. Irwin, Essentials of Electrical and Computer Engineering, Pearson, 2004.
2. J. D. Irwin and D. V. Kerns, Introduction to Electrical Engineering, Prentice Hall, 1995.

3. R. J. Smith and R. C. Dorf, Circuits, Devices and Systems, Wiley, 5th edition, 1992.