National Chiao-Tung University
Computer Science and Information Engineering Department
Electrical & Electronic Circuits, Course Review

January 2013

Part I : Basic Electrical Circuits

- ***Electric Components & Measurements***
  - Active Components: Voltage / Current Sources
  - Passive Components: Resistors, Capacitors, Inductors
  - Linearity & Time Invariance
  - Absolute, DC, AC & RMS Measurements
- ***Electric Circuit Equations***
  - Kirchhoff's Voltage and Current Laws (KVL and KCL)
  - Construction of Circuit Equations based on KVL & KCL
- ***One-Port Circuit Model***
  - Thevenin's Equivalent (Non-Ideal Voltage Source)
  - Norton's Equivalent (Non-Ideal Current Source)
- ***Two-Port Circuit Model***
  - Input Impedance/Resistance
  - Output Impedance/Resistance
  - Transfer Functions
    - *Voltage / Current Gains*
    - *Trans-impedance / Trans-conductance*
- ***Circuit Coupling***
  - Voltage & Current Coupling
  - DC & AC Coupling
  - Ideal Voltage / Current Sources
  - Ideal Voltage / Current Loads
- ***Time Domain Analysis***
  - Impulse Response
  - Sinusoidal Response
  - Driving Free (Initial Value) Response
  - Steady State Response

- ***Laplace Transforms of Circuit Equations***
  - Laplace Transform, Concepts
  - Basic Operations and Transform Pairs
  - Impedance and Admittance
  - System Poles and Zeros

Part II : Basic Electronic Circuits

- ***Analog Circuits with Operational Amplifiers (OPs)***
  - Characteristics of Ideal OPs
    - *Virtual Node at Differential Input*
    - *Ideal Voltage Source as Output*
  - Basic Concepts of Negative Feedback
    - *Signal Flow Diagrams (SFGs)*
    - *Open & Close Loop Gains*
    - *Common Feedback Circuits with OPs*
  - Applications of OPs
    - *Voltage Follower*
    - *Inverting Amplifiers*
    - *Non-inverting Amplifiers*
    - *Multi-input Summers*
- ***CMOS Digital Logic Circuits***
  - Operation Principle of CMOS Logic Circuits
    - *nMOS & pMOS as Switches*
    - *Complementary Operation of PUN & PDN – Active Low & Active High*
  - Design Principle of CMOS Logic Circuits
    - *pMOS Pull-Up Network (PUN)*
    - *nMOS Pull-Down Network (PDN)*
    - *Switches-in-Parallel & Switches-in-Series*
    - *Design of PUN & PDN based on De Morgan's Law*
  - Examples of CMOS Logic Circuits
    - *Inverter*
    - *NAND & NOR*
    - *XOR*