EE 201 Final Exam Study Guide
Fall 2013-14

Warning:
This is <u>not</u> an exclusive list of all topics covered in EE 201.
Please check the course syllabus for the list of all topics.

Required Mathematical Knowledge:

a) **Simple Linear Algebra (matrices, inversion of matrices, determinants etc.)**
b) **Basic Differential Equations knowledge (particular, homogeneous solution)**
c) **Solution technique constant coefficient differential equations (CCDE) (required for the solution of 1st and 2nd order LTI circuits)**

Basic Topics:
Must know!

a) **KVL, KCL**
b) **Passive sign convention**
c) **Series/parallel combination of resistors**
d) **Voltage division/current division for resistors**
e) **Series/parallel combination of capacitors (uncharged capacitor)**
f) **Voltage division/current division for capacitors (uncharged capacitor)**
g) **Series/parallel combination of inductors (uncharged inductor)**
h) **Voltage division/current division for inductors (uncharged inductor)**
i) **Relation between power and energy**
j) **Op-amp ideal model**
k) **Diode ideal model**
l) **Component equations for coupled inductors, transformers (dot convention)**
m) **Units of circuit variables, (V, A,W, J)**

Core Topics:
Must know!

a) **Circuit analysis techniques (Node, Mesh equations)**
b) **Circuit simplification methods (Delta – Y, Thevenin-Norton, Source Trans.)**
c) **Maximum power transfer**
d) **Op-amps with LTI resistors (Three region analysis, input and transfer char.)**
e) **Two-ports (Parameter finding, converting one parameter set to another)**
f) **Ideal diodes (Finding i-v char. of one-ports containing diodes, LTI resistors and independent sources; designing circuits with diodes to realize a desired i-v char.)**
g) **Decomposing a given function of time in terms of u(t), ramp(t) and its time-shifted versions.**
h) **Initial condition models for dynamic components**
i) **First Order Circuits (zero-input, zero-state responses)**
j) **Second Order Circuits (underdamped, overdamped, critically damped cases; solving for zero-input, zero-state and complete responses)**
k) **Concepts of natural frequency and characteristic equation**
l) **Concept of state variable (V_C and I_L)**
m) **Relations between impulse, step and ramp responses**
n) **Analysis of first and second order circuits at $t = 0^+$**
o) **Analysis of first and second order circuits with <u>DC inputs</u> (what happens as $t \to \infty$, time-constant τ for 1st order circuits)**

Combined Topics:

Study these topics once you have fully covered Core Topics

a) **More realistic models for op-amps (finite gain, finite R_{in} etc.)**
b) **Op-amps with non-linear elements**
c) **Current/Voltage division when capacitors/inductors are initially charged**
d) **First order circuits with LTI components and ideal diodes (non-linear elements)**
e) **First order circuits with LTI components and op-amps operating in all three regions, i.e. when op-amp is not limited to the linear region**
f) **Finding zero-state response of 1^{st} and 2^{nd} order circuits by decomposing the given input in terms of u(t), ramp(t) and its shifted versions**
g) **Dynamic (1^{st} and 2^{nd} order) circuits with switches (piecewise time-invariant circuits):**
    i. **Continuity of state variables (V_C and I_L) under bounded inputs**
    ii. **Jump (discontinuity) in the state variable values due to the pathological switch movements, i.e. putting the capacitors in parallel (or inductors in series) by switch movements.**
    iii. **How to find just-after switching value of state variables in the pathological cases**

Additional Topics:

a) **Concepts related with circuit graphs**
b) **Duality, dual graph, dual circuit**
c) **Applications of reciprocity**
d) **Symmetric circuits**
e) **Tellegen's theorem and its significance in reciprocity, conservation of power**