ENGG 2450

ENGG*2450 Electric Circuits Concept Review

The Engineering Peer Helpers

Chapter 1 and 2 : Basic Concepts and Basic Laws

I. Concepts

- Resistors
  - Series and parallel
  - 1/R → parallel
  - Using transformations to simplify complex circuits
- Sources (dependent, independent)
  - Dependent is diamond → rely on other circuit components (ex: $4i_1$)
  - Independent is circle
- Current
- Voltage and current division (helpful for later chapters in the course)
  - When you have to find a single voltage or current
  - With different branches and resistors etc.
- Conductance
  - 1/R (reciprocal)
  - Convert if you are given in a question
- Laws
  - Ohms (V=IR)
  - Kirchhoff's
  - Nodal (sum of the current at a node must sum to zero)
  - Loop (sum of voltage in a loop is equal to zero)

- Directions with voltages → stay consistent and work from defined directions

II. Tips and Tricks

- Textbook → summaries at end of chapters
  - Formulas, theories, laws, etc.
- Create summary sheets
- Practice with formula sheet
- State assumptions and define any conventions you are using
- Identify each formula, identify each of the units & know what every variable represents

III. Blank Space – Formulas, Diagrams etc.

- Transformation formulas
- Conventions (CW and CCW)

Chapter 3 : Methods of Analysis

IV. Concepts

- Nodal Analysis
- Supernode
  - Source in between components in cct and not attached to ground
  - From chapters 1 and 2 can use laws and theorems to solve
  - Use KCL and KVL and then that source gives you nodal voltage and then nodal analysis without a supernode
- Mesh Analysis
  - When to use nodal versus mesh analysis?
  - A cct w fewer nodes than meshes is usually better with nodal analysis
  - Mesh is an independent loop within the cct → more cubic of a cct

- Usually have to use linear algebra to solve system of equations from mesh analysis

- Supermesh
  - When you have two meshes that share a current souce → when you create a supermesh
  - Has no current of its own
  - Exclude source and any elements in series with it

V. Tips and Tricks

- Highlight ground branch and then anything connected to that you know is not a supernode bc connected to ground
- Colour code circuits to better visualize
- Node voltages asked? Maybe use nodal analysis
- Mesh/branch current asked? Mesh analysis may be better
- Interchanging methods or using both to get final answer
- Stay consistent with your class notes
- High to low potentials
- Identify nodes and branches in the loops and depending on the cct will decide whether or not nodal or mesh analysis may be better
- Take time before you approach a problem to make a plan for how to solve
- Collaborate and study with people in your course
- Nodal analysis you cannot do transistor applications (in further chapters)

VI. Blank Space – Formulas, Diagrams etc.

- Consistent with voltages
- Defining assumptions and conventions

Chapter 4 : Circuit Theorems

VII. Concepts

- Thevenin/Norton
  - Rth=Rn
  - Relate load of cct to voltage source and resistor
  - Norton finds current and Thevenin finds voltage
  - Working with parallel versus series
  - One of the best ways to simplify a cct
  - The terminals → make sure you do Thevenin and Norton between the terminals and not the entire cct
- Superposition
  - Summation of simpler circuits
  - When you have lots of sources within a cct (current or voltage sources)
  - “Turn off” independent sources except one
  - Only consider one independent source at a time and then replace those voltage sources → either a short circuit (V) or open circuit (I)
  - Leave dependent sources in
    - Will change if you were to take them out
  - Use KVL and KCL depending on question
  - Time consuming method
- Source transformations
  - Important for future courses
  - Relies on equivalence
  - Using Thevenin and Norton to transform voltage sources into current sources
    - Vs=ir
    - Is=v/r

- Voltage source and resistor in series can be transformed to current source and resistor in parallel
- Can be related to delta y simplifications
- When converting does not increase the simplicity → use another method

- Linearity
  - Relation between output and input (directly)
  - Direct proportionality (ohms law is linear V=IR)
  - Quadratic relationships you cannot use this strategy
  - Important for theory-based questions when relating different values and elements within the cct
  - Scalar multiples etc. for conceptual questions
  - Homogenous formulas

VIII. Tips and Tricks

- Relationship based questions → hint for linearity-based questions
- Note if they ask you to use certain methods within the question
- With source transformations you can change how cct looks to something you are more comfortable with
- Comfortable switching between Thevenin and Norton
- Figure out what the question is asking you specifically
- Textbook is very helpful for this chapter
- Source transformations rely on equivalent resistances and current/voltage division
- Concepts used for larger ccts
- If it becomes more complicated → may be better to use a different method

IX. Questions and Contact

a) This will be posted on The Engineering Peer Helpers (EPH) Website.

   i) https://www.uoguelph.ca/engineering/content/current/peer-helper

b) There will not be a filled in version posted. Please write notes during the session.

c) Stay tuned for more ENGG*2450 workshops/sessions before the final exam.

d) Email for a small-group consultation. It's great to think of your questions and send them beforehand!

e) Book a one-on-one consultation for circuits!