Date, Time and Location: Monday, December 16 from 6pm-9pm in Workman 101.

Resources Allowed: Calculator, writing/erasing utensils and one 4"× 6" index card with writing on both sides.

Chapters and Sections Covered: 1-6, 8.1, 8.2

Note: All work must be shown neatly and completely for full credit.

Topics:

1. Circuit Variables
    *   Voltage, current, power, energy
    *   Passive sign convention
    *   Definitions, units and physical interpretations

2. Circuit Elements
    *   Resistors, capacitors, inductors
        o   Symbols
        o   Units
        o   Voltage-current relationships
        o   Physical interpretations/characteristics
    *   Independent and dependent sources
        o   Symbols
        o   Voltage-current relationships
    *   Operational amplifiers (op-amps)
        o   Symbol
        o   Ideal op-amp assumptions

3. Circuit Analysis Tools
    *   Use to analyze circuits and find variables of interest
    *   Reduction by equivalent elements
    *   Kirchhoff's Voltage Law (KVL)
    *   Kirchhoff's Current Law (KCL)
    *   Voltage and current division
    *   Nodal analysis
    *   Mesh analysis
    *   Thévenin and Norton equivalent circuits

4. Ramp, Step, and Impulse Functions
    *   Definitions and relationships
    *   Graph ⇔ equation
    *   Use in circuit analysis

5. Circuits with Energy Storage Elements
    *   Switching via switches or step functions
    *   Initial conditions
    *   Differential equation(s) needed for variable of interest using circuit analysis tools
    *   Solve differential equation for total response (natural plus forced)
    *   Interpret results in terms of type of response (1st-order: real exponential, 2nd-order: over damped, under damped, critically damped), time constants, frequency of oscillation, attenuation and phase shifts

6. Complex Numbers
    *   Rectangular to polar conversion
    *   Calculations
    *   Graphs