The George Washington University
School of Engineering and Applied Science
Department of Electrical and Computer Engineering
ECE 20 - LAB
Midterm Project – DC Power Supply

Objectives:

Your goal is to simulate, design, build and demonstrate a practical DC power supply that can be used as the power supply of various consumer electronic devices. Your power supply must meet or exceed following specifications:

Prelab (due at the beginning of the demonstration lab)

Complete the following before coming to the lab and submit a copy to the instructor. Please make sure to keep a copy for your reference.
1. Complete circuit diagram drawn on PSPICE
2. Brief working principle of the circuit. (Show your technical understanding of the circuit here)
3. PSPICE simulation

Design Specifications:

- Your power supply will have an on state indicator (LED)
- Input Voltage: 120V rms @ 60Hz
- Voltage Output: Two regulated outputs of 12V and -12V respectively
- Load regulation: Less than 2%
    1. Assume 100 ohm full load. (You can connect multiple resistors in parallel , so that none of the resistors dissipates more power than its maximum power limit.)
        a. Instead of resistors in parallel a 'power resistor' may be used
    2. Note, GTA may set the load to 10 Ohms, to allow midterm project to support the load of the final project – 10 W_{RMS} Amplifier
    3. An inductor may need to be inserted in design to meet ripple requirements
- Ripple: Less than 1%

Demonstration (60%):

You have to demonstrate that your circuit meets all the specification to your GTA
    (see grading criteria on the next page to see how the demonstration will be graded)

Report (40%) (due the week after the demonstration):

Write a brief report (using the lab report format) which will include following:
- Block Diagram of major stages
- Circuit Diagram
- PSPICE simulation
- Circuit Theory and operation
- Test results meeting the specifications

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ECE 20 - ENGINEERING ELECTRONICS

Midterm Project Grading Sheet

Student's Name: _____

===SETUP (45 pts total)===
 (student must have each item with circuit to show TA during demonstration)

Schematic + Hand calculations must contain:
____(2.5pts) Schematic
____(5pts) Ripple calculation, correctly determining size of filter capacitor
____(5pts) Load resistor calculation, accounting for individual power dissipation of resistor
____(2.5pts) Load regulation calculation
____(5pts) LED's resistor size calculation
____(5pts) Current draw of each branch calculated, meets regulator spec
____(5pts) Power dissipation of all components after regulator calculated
____(2.5pts) Neatness

____(5pts) Spice Simulation w/graphs
____(2.5pts) Proper Calibration of Oscilloscope
            (Channel 1 on source voltage, Channel 2 on output signal, lose points for auto-set)
____(5pts) Student is able to explain operation of circuit

===CIRCUIT DEMONSTRATION (55 pts total)===

(student is to perform all measurements – show to TA)

____(5pts) LED indicator lights up
____(5pts) DMM measures 12VDC across load
____(5pts) DMM measures -12VDC across load
____(5pts) Proper Output of Voltage Regulator on Scope (12 VDC overlaid onto Channel 1)
____(2.5pts) Ripple < 1%
____(2.5pts) Load Regulation < 2%
____(5pts) Proper Output of Filter Capacitor on Scope
____(5pts) Proper Output of Rectifier on Scope (May need to pull filter cap)
____(2.5pts) Proper Load Resistance = 100 Ohms (or 16 ohms)
____(5pts) Power Dissipated by load = 1.44 Watts (measure current to show) (or 9 Watts)
____(5pts) Power dissipated by each load resistor below tolerance limit of resistor (require
            measurement of current to verify)
____(5pts) Current flowing in LED branch ~20mA
____(2.5pts) Voltage across LED < 3V

TOTAL: _____ (100pts)