EEL 3302; ELECTRONICS I

CAD #2 – 10/3/07 Student _____
(Print Name Clearly)

INSTRUCTIONS

1. All CAD assignment write-ups must contain the following elements presented in order.
   a) This page with name and signature affixed.
   b) A summary page containing PSPICE results compared with formulae and calculator ("by hand") results, together with an explanation of any differences. Summary is page 1.
   c) A complete PSPICE circuit diagram (schematic) showing the bias voltages and currents, a complete listing of the PSPICE output file, and all graphs required by the assignment for each separate simulation. You may have to repeat this section several times depending on the assignment.
   d) The "by hand" calculations and any associated required figures.

2. Use a comprehensive word processing application (such as WORD®) to assemble your report. All pages must have a printed header or footer (your choice) containing the CAD assignment number, student name, date and page number. All tables, schematics, graphs, and drawings must be captioned starting with Table 1, Figure 1, etc. Reference the page and figure caption for data presented on the summary page. Mark the location on any graph where data is taken for the summary page. Orient figures to give the largest possible presentation and do not place more than one figure on a page. Reverse the PSPICE graph background from black to white. The "by hand" calculations and figures may be handwritten but all other requirements must be satisfied. Use 8½" x 11" printer paper for all PSPICE results and the "by hand" calculations and any associated required figures. Do not print or write on the bac kside of any page. "Portrait" pages must have the top aligned with the top of the stack. "Landscape" pages must have the top aligned with the left of the stack. Secure all pages with one staple in the far upper left corner of the stack. All material on each page should be visible. Work failing to conform to these specifications will not be accepted and a grade of "0" will be assigned. Late write-ups will not be accepted without good cause, e.g., documented medical problem, employer required travel.

3. Students are encouraged to collaborate in the initial effort where the emphasis is on understanding and determining a course of action. Students are prohibited from any collaboration, cooperation and conversation in the performance of the simulation, "by hand" analysis and write-up. Write-ups that are unacceptably similar will be challenged and may be considered as academic dishonesty.

This work is solely the product of my effort. I have neither given nor received assistance related to this assignment, and I have read, understood and complied with the requirements of this assignment to the best of my knowledge.

_____
(signature)

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This CAD exercise demonstrates the operation of a half-wave rectifier circuit.

Construct a test setup consisting of a sinusoidal time-domain voltage source, a D1N4002 diode and a 200-Ohm resistor connected in series. Connect one side of the resistor to the negative side of the source. Ground the negative side of the source. Set the source to provide 10 V peak at 60Hz with no dc offset.

Perform a PSPICE transient analysis to illustrate the rectifier operation. Enable output file Fourier analysis for 10 harmonics. Plot the source voltage, the load voltage and the load current on the same graph. Place markers on the peak values of load voltage and load current.

Calculate the maximum load voltage and load current by hand. Use 700 mV for the diode forward voltage. Compare the calculated values with the values from the simulation. Calculate the average load voltage (dc value) by hand. Compare the calculated value with the dc value in the Fourier analysis from the simulation.

Add a 100 uF electrolytic capacitor in parallel with the resistor being careful to observe the capacitor polarity. Perform a PSPICE transient analysis to illustrate the rectifier operation with a filter capacitor present. Enable Fourier analysis for 10 harmonics. Plot the source voltage, the load voltage, and the capacitor current on the same graph. Place markers on the maximum and minimum values of the load voltage. Place markers on the capacitor current at the points just after the diode is completely off and just before the diode turns on. Note the time that the diode turns off. Place markers on the source voltage and load voltage at the diode turn-off time. Note the time that the diode turns on. Place a marker on the load voltage at the turn-on time.

Calculate the load voltage using the load resistance and the load current value from the simulation at the points just after the diode is completely off and just before the diode turns on by hand. Compare the calculated values with the values from the simulation. Calculate the diode forward voltage using the source voltage and load voltage values from the simulation at the load voltage maximum and just after the apparent diode turn-off by hand. Read the diode current at the calculated diode forward voltage values from the I-V graph created in the first part of CAD #1. Compare the diode current values from the CAD #1 graph with the values from the simulation. Assume that the peak capacitor discharge current is approximately equal to the diode current at the source voltage maximum. Calculate the average load voltage (dc value) by hand. Compare the calculated value with the dc value in the Fourier analysis from the simulation. Compare the Fourier component values (including dc) from the simulations with and without the capacitor.

This assignment is due at the beginning of class on Monday, October 15, 2007.