ECE 320 - Homework #4

Min/Max, AC to DC, DC to DC. Due Monday, September 19th

Min/Max:

1) Determine the voltages and currents for the following circuit. Assume ideal silicon diodes.



Problem 1: Max/Min Circuit

- 2) Design a circuit to meet the following requirements:
 - Input: 3 voltages (A, B, C), 0 to 10V, capable of driving 10mA
 - Output: Y: 0 to 10V, capable of driving 10mA
 - Relationship: Y = max(A, min(B, C)), +/- 500mV Y = A (B + C)

AC to DC:

Problem 3 & 4: Design a circuit to meet the following requirements:

- Input: 12Vp, 60 Hz sine wave
- Output: Resistor (DC load)
- Relationship: 10mA DC is provided to the load with a ripple of 1Vpp
- 3) Half-Wave Rectifier:
 - a) Find the peak voltage for Vc
 - b) Find R so that the peak current in the load is 10mA
 - c) Find C so that the ripple is 1Vpp



Problem 3: Half-Wave Rectifier

- 4) Repeat for the following full-wave rectifier:
 - a) Find the peak voltage for V1
 - b) Find R so that the peak current in the load is 10mA
 - c) Find C so that the ripple at V1 is 1Vpp
 - d) Find L so that the ripple at V2 is 100mVpp



Problem 4: Full-Wave Rectifier

DC to DC Converter

- Input: 12VDC
- Output: Resistor
- Relationship: 10mA to the load with a ripple of 100mVpp
- 5) Design a Buck converter to meet these requirements
 - a) Find the duty cycle for the switch so that the average voltage at V1 is 5V
 - b) Find R so that the load draws 10mA
 - c) Find L so that the ripple at V2 is 1Vpp (asume C = 0)
 - d) Find C so that the ripple at V2 is reduced to 100mVpp



Problem 5: Buck Converter

Lab:

- 6) Simulate one of these circuits in PartSim (or similar software) to check your analysis
- 7) Build one of these circuits in lab and collect data to verify your analysis