EECE418 Power Electronics
Dr. Charles Kim

Assignment 3: Ch6 : DC-DC Converters

A. Instruction:
Solve the following **Chapter 6** problems. Use of Smath Studio is encouraged in the calculations.

Academic Honesty: If any two or more submitted works are (almost) identical, all such works will be considered as cheated ones, and are subject to 0 point first and then to possible additional disciplinary action from the university.

B. Score Distribution and Rubric:

Prob #	**Description**	**Point Distribution (by the quality of the answer)**
Each problem	Show all the calculation process	10
	Calculation process is limited	5
	Does not show calculation process	0

C. Submission: Submit either (a) hand-written and sketched works or (b)typed report with computer generated sketch in the following file name: **HW3_YourLastName.xxx**

D. Submission due: Check the webpage

E. Late submission Point Deduction (**Maximum score percentage by submission date**)

Submission Time/Date	Maximum score percentage
By 8:00pm submission date (M)	100
By 5:00pm submission date + 1 (T)	70
By 5:00pm submission date + 2 (W)	50
After the above	0

F. Problems

6-6. The buck converter of Fig. 6-3*a* has an input of 50 V and an output of 25 V. The switching frequency is 100 kHz, and the output power to a load resistor is 125 W. (*a*) Determine the duty ratio. (*b*) Determine the value of inductance to limit the peak inductor current to 6.25 A. (*c*) Determine the value of capacitance to limit the output voltage ripple to 0.5 percent.

6-9. A buck converter has an input voltage that varies between 50 and 60 V and a load that varies between 75 and 125 W. The output voltage is 20 V. For a switching frequency of 100 kHz, determine the minimum inductance to provide for continuous current for every operating possibility.

6-17. The boost converter of Fig. 6-8 has parameter $V_s = 20$ V, $D = 0.6$, $R = 12.5\ \Omega$, $L = 10\ \mu$H, $C = 40\ \mu$F, and the switching frequency is 200 kHz. (*a*) Determine the output voltage. (*b*) Determine the average, maximum, and minimum inductor currents. (*c*) Determine the output voltage ripple. (*d*) Determine the average current in the diode. Assume ideal components.

6-20. Design a boost converter to provide an output of 18 V from a 12-V source. The load is 20 W. The output voltage ripple must be less than 0.5 percent. Specify the duty ratio, the switching frequency, the inductor size and rms current rating, and the capacitor size and rms current rating. Design for continuous current. Assume ideal components.

6-23. The buck-boost converter of Fig. 6-11 has parameters $V_s = 12$ V, $D = 0.6$, $R = 10\ \Omega$, $L = 10\ \mu$H, $C = 20\ \mu$F, and a switching frequency of 200 kHz. Determine (*a*) the output voltage, (*b*) the average, maximum, and minimum inductor currents, and (*c*) the output voltage ripple.

6-25. The buck-boost converter of Fig. 6-11 has $V_s = 24$ V, $V_o = -36$ V, and a load resistance of 10 Ω. If the switching frequency is 100 kHz, (*a*) determine the inductance such that the minimum current is 40 percent of the average and (*b*) determine the capacitance required to limit the output voltage ripple to 0.5 percent.