

EE 452 – Power Electronics Design, Fall 2021
Homework 7

Due Date: Friday December 3rd 2021, 11:59 pm Pacific Time

Instructions. You must scan your completed homework assignment into a pdf file, and upload your file to the Canvas Assignment page by the due date/time above. All pages must be gathered into a single file of moderate size, with the pages in the correct order. Set your phone or scanner for basic black and white scanning. You should obtain a file size of hundreds of kB, rather than tens of MB. I recommend using the "Tiny Scanner" app. Please note that the grader will not be obligated to grade your assignment if the file is unreadable or very large.

Description A simple buck converter operates with a 50 kHz switching frequency and a dc input voltage of $V_g = 40\text{ V}$. The output voltage is $V = 20\text{ V}$. The load resistance is $R \geq 4\ \Omega$.

- (a) Determine the value of the output filter inductance L such that the peak-to-average inductor current ripple is 10% of the dc component I .
- (b) Determine the peak steady-state inductor current I_{\max} .
- (c) Design an inductor which has the values of L and I_{\max} from parts (a) and (b). Use a ferrite EE core, with $B_{\max} = 0.25\text{ T}$. Choose a value of winding resistance such that the inductor copper loss is less than or equal to 1 W at room temperature. Assume $K_u = 0.5$. Specify: core size (core type and geometrical constant K_g), gap length, wire size (AWG), and number of turns. Use tables in Appendix D of book as necessary.