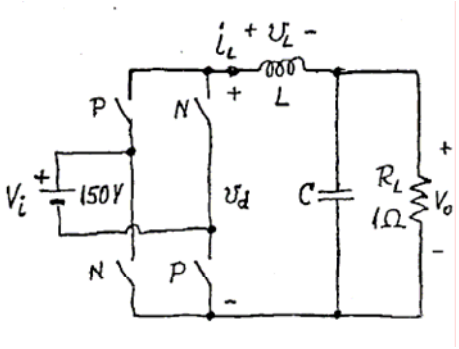
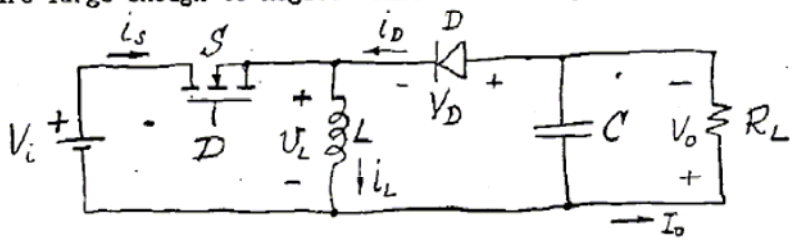
PROBLEM 1: Assume that all the components of the converter in Fig. 1 are ideal and that the capacitor C is very large. If the switches P and N are operated complementarily with constant switching frequency of 5 kHz and the duty cycle of the P switches is $D_P = 2/3$:

a) Sketch the steady-state waveforms of v_d, v_L, and i_L, over one switching cycle.
b) Find the output voltage V_o.
c) Find the value of the inductance L so that the inductor current peak-to-peak ripple is $\Delta i_L \leq 10$ A.



PROBLEM 2: Dc-dc converter in Fig. 2 operates with D = 1/3 and delivers 450 W to the load of R_L = 0.5 Ω. Find the efficiency of the converter if the diode forward voltage drop is V_D = 1 V, MOSFET on-resistance is $R_{ON} \approx 100$ mΩ, while the switching losses and losses in C and L can be neglected. Assume that L and C are large enough to neglect influence of any current and voltage ripple.



PROBLEM 3: DC-DC converter in Fig. 3 operates in continuous current conduction mode with constant switching frequency. Assume that all the components are ideal and that L and C are large.

a) Find the value of the switch duty cycle, D, so that $V_o = 15$ V when $V_i = 12$ V.
b) Sketch the steady-state waveforms of v_S, i_S, v_D, and i_D, over one switching cycle.
c) Find the maximum voltage across the switch, S, and the switch average current.
d) Find the maximum reverse voltage across the diode, D, and the diode average current.