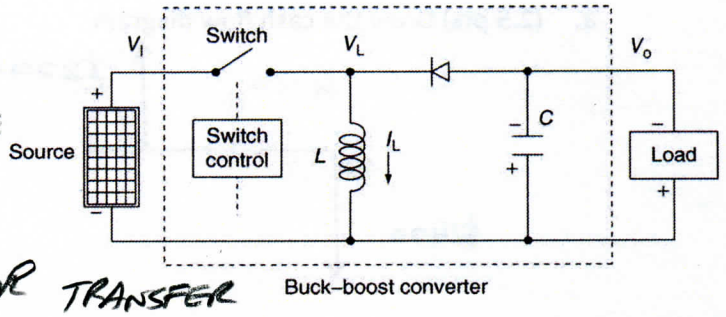
LAST NAME SOLUTION Alphabetic # _____

FIRST NAME _____

Quiz 6

1. Buck – Boost Converter. See figure

a. (2 pts) What purpose does the buck boost converter serve in the system shown.



ENABLES MATCHING PV SOURCE OPTIMAL POWER POINT TO THE LOAD'S OPTIMAL POWER POINT....

- ie. FACILITATING MAXIMUM POWER TRANSFER
- ie ADJUSTING VOLTAGE FROM PV. TERMINAL TO OPTIMUM LOAD VOLTAGE.

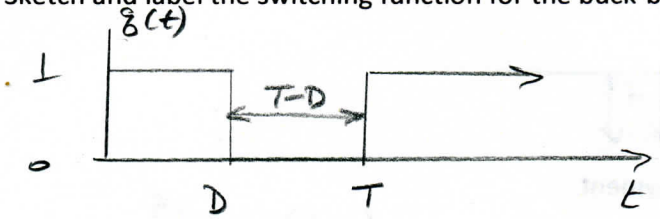
b. (2 pts) What is the current – voltage relationship in the capacitor? What power supply type does it behave like over short time periods?

$$i = C\frac{dv}{dt} \quad ; \quad \text{VOLTAGE SUPPLY}$$

c. (2 pts) What is the current – voltage relationship in the inductor? What power supply type does it behave like over short time periods?

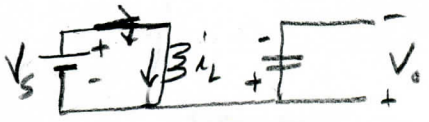
$$v = L\frac{di}{dt} \quad ; \quad \text{CURRENT SUPPLY}$$

d. (2 pts) Sketch and label the switching function for the buck-boost converter



e. (2 pts) Use the logic used to develop buck and boost DC-DC converters in class to develop duty cycle relationship for the buck-boost converter shown in the figure.

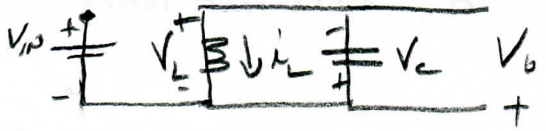
FOR $g(t)=1$



$V_L = V_s = V_{IN}$

$V_L = g(t)V_{IN}$

FOR $g(t)=0$



$V_L = (1-g(t))V_o$

$V_L = g(t)V_{IN} + (1-g(t))V_o$

$\langle V_L \rangle = 0$

$g(t)V_{IN} = -(1-g(t))V_o = (g(t)-1)V_o$

$V_o = \frac{D}{D-1}V_{IN}$

NAME SOLUTION

2. You have a project that returns \$1000 and \$2000 at the end of years 1 and 2 respectively. Your initial investment is \$2400 at the outset. Assume a 10% discount rate.

$$\text{Simple payback (yr)} = \frac{\text{Extra first cost } \Delta P}{\text{Annual savings (\$/ yr)}}$$

$$CF = \frac{\text{Energy delivered}}{\text{Energy@full pwr}}$$

$$PVF(d,n) = \frac{(1+d)^n - 1}{d(1+d)^n}$$

$$NPV_{\text{savings}} = \Delta A \cdot PVF(d,n) - \Delta P$$

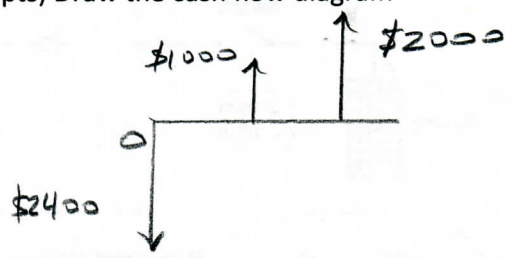
$$NPV = \Delta A \cdot PVF(IRR,n) - \Delta P = 0$$

$$PVF(IRR,n) = \frac{\Delta P}{\Delta A}$$

$$CRF(i,n) = \frac{i(1+i)^n}{(1+i)^n - 1}$$

$$FV = PV(1+i)^n$$

a. (2.5 pts) Draw the cash flow diagram



b. (2.5 pts) What is the net present value?

$P_1 = (1.1)^{-1} \cdot 1000$

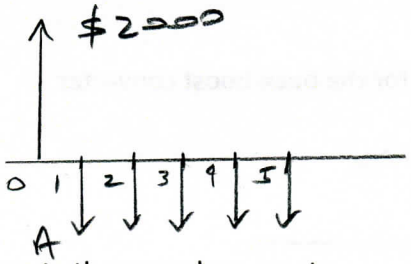
$P_2 = (1.1)^{-2} \cdot 2000$

NPV = $-2400 + 909 + 1652 = \$161.9$ ANS.

3. You want to borrow \$2000 at 6% rate to be repaid back in equal payments over 5 years.

a. (2.5 pts) Draw the cash flow diagram

$i = .06$



b. (2.5 pts) Compute the annual payment.

$$A = CRF \cdot \frac{i(1+i)^n}{(1+i)^n - 1} = 2000 \frac{(.06)(1.06)^5}{(1.06)^5 - 1} = 2000 \times .2374$$

$A = \$474$ (PER YEAR)

Bonus

a. (2 pts) Define Leadership INFLUENCING PEOPLE TO ACT TO COMMON PURPOSE

b. (2 pts) Define Management ALLOCATING RESOURCES.