Unit 12 - Week 10

Assignment 10

The due date for submitting this assignment has passed. Due on 2020-04-08, 23:59 IST.
As per our records you have not submitted this assignment.

1) State whether the following statement is true or false. "An inductive switching DC-DC converter is more efficient than a switched capacitor DC-DC converter over a wide range of the voltage conversion ratio V_O/V_{IN}." *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
True

2) State whether the following statement is true or false. "Average current sensing can also be used to determine the peak current but not vice versa." *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
False

3) What must be done to avoid a discontinuity in the output voltage when a tri-mode buck-boost converter transitions from buck to buck-boost mode? *1 point*

- Increase D_{BUCK} after the transition
- Decrease D_{BUCK} after the transition
- Increase D_{BOOST} before the transition
- Increase D_{BOOST} after the transition

No, the answer is incorrect.
Score: 0
Accepted Answers:
Decrease D_{BUCK} after the transition

4) What must be done to avoid a discontinuity in the output voltage when a tri-mode buck-boost converter transitions from buck-boost to boost mode? *1 point*

- Decrease D_{BUCK} before the transition
- Decrease D_{BUCK} after the transition
- Decrease D_{BOOST} before the transition
- Decrease D_{BOOST} after the transition

No, the answer is incorrect.
Score: 0
Accepted Answers:
Decrease D_{BOOST} after the transition

5) Which of the following current sensing methods provides best accuracy? *1 point*

- MOSFET R_{ds_on} sensing
- RC filter sensing
- Off-chip series sense resistor
- Sense FET with matched V_{DS}

No, the answer is incorrect.
Score: 0
Accepted Answers:
Off-chip series sense resistor

6) A switched capacitor DC-DC converter was designed to operate for V_{IN} = 2.5 V to 4.5 V and V_{OUT} = 3.3 V. Which of the following gain configurations will offer the best efficiency? *1 point*

- 1x and 2x
- 1x and 1.5x
- 1.5x and 2x
- 1.5x only

No, the answer is incorrect.
Score: 0
Accepted Answers:
1x and 1.5x

Consider the buck-boost converter shown in Figure 1, for questions 7 to 11. It needs to be designed for the following specifications. V_{IN} varies from 2.7 V to 5.5 V, V_O = 3.3 V, F_{SW} = 1 MHz, L = 1 µH and C_O = 10 µF. Assume that the maximum buck duty cycle is $D_{BUCK,\ MAX}$ = 0.95 and that the minimum boost duty cycle is $D_{BOOST,\ MIN}$ = 0.05. Neglect all conduction and switching losses. Use information provided / obtained in a previous question to answer subsequent questions. Adhere to the units mentioned in the question while filling in numerical answers. The duty cycle D always lies between 0 and 1.

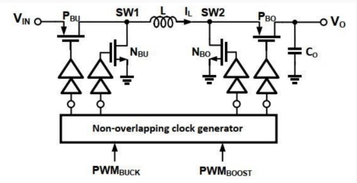

Figure 1

7) Fill in the blank with a numerical answer: The buck-boost converter (shown in Figure 1) transitions from boost to buck-boost mode at V_{IN} = ____ volt (up to 3 decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 2.82,3.44

1 point

8) Fill in the blank with a numerical answer: The value of the boost duty cycle that is required to meet the boundary condition when the buck-boost converter (shown in Figure 1) transitions from boost to buck-boost mode is D_{BOOST} = ____ (up to 3 decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.087,0.107

1 point

9) What mode does the buck-boost converter (shown in Figure 1) operate in, when V_{IN} = 3.4 V and V_{OUT} = 3.3 V? *1 point*

- buck
- boost
- buck-boost

No, the answer is incorrect.
Score: 0
Accepted Answers:
buck-boost

10) Fill in the blank with a numerical answer: The value of the boost duty cycle that is required for the buck-boost converter (shown in Figure 1) to operate at maximum efficiency when V_{IN} = 3.4 V and V_{OUT} = 3.3V is D_{BOOST} = ____ (up to 2 decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 0.05

1 point

11) Fill in the blank with a numerical answer: The value of the buck duty cycle that is required for the buck-boost converter (shown in Figure 1) to operate at maximum efficiency when V_{IN} = 3.4 V and V_{OUT} = 3.3 V is D_{BUCK} = ____ (up to 2 decimal places).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.83,1.02

1 point

12) Consider the buck converter shown in Figure 2, for question 12. The G_m -C filter in the said buck converter was used to sense the inductor ripple current with the following specifications.
V_{IN} = 2 V, V_O = 1 V, L = 1 µH, C_O = 10 µF, switching frequency F_{SW} = 1 MHz and C = 10 pF. Assume that the buck converter is ideal and neglect all losses. Adhere to the units mentioned in the question while filling in the numerical answer

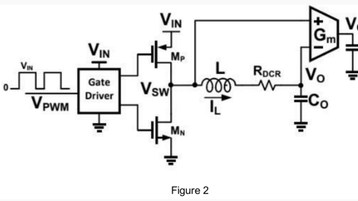

Figure 2

Fill in the blank with a numerical answer: The value of the transconductance (in respect of the circuit shown in Figure 2) for which the ripple amplitude of the G_m -C current sensor output voltage (V_C) has the same amplitude as the inductor ripple current (ΔI_L) is G_m = ____ µS (up to 1 decimal place).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 9,11

2 points

Consider the charge pump shown in Figure 3, for questions 13 and 14. Adhere to the units mentioned in the question while filling in a numerical answer.

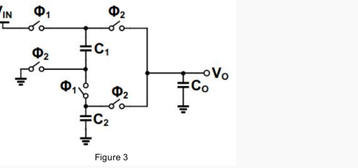

Figure 3

13) Fill in the blank with a numerical answer: Assuming that Φ_1 and Φ_2 are non-overlapped complementary clocks and that $C_1 = C_2$, the value of the voltage transfer ratio V_O/V_{IN} is ____ (up to 1 decimal place).

Additional exercise (not evaluated): Find the general expression for the voltage transfer ratio V_O/V_{IN} when C_1 and C_2 are unequal.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 0.5

1 point

14) Fill in the blank with a numerical answer: If the output voltage of the charge pump is regulated using a feedback loop, then for $V_{IN} = 3.5\ V$ and $C_1 = C_2$, the value of the output voltage V_O at which the charge pump operates with maximum efficiency, is ____ volt (up to 2 decimal places).

Additional exercise (not evaluated): Solve this question for $C_1 = 2C_2$ and for $C_2 = 2C_1$.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Numeric) 1.75

1 point