

Test Date: 03/04/2008

Total Problems: 3

Total Pages: 6

Name: _____

1. (40 points) _____

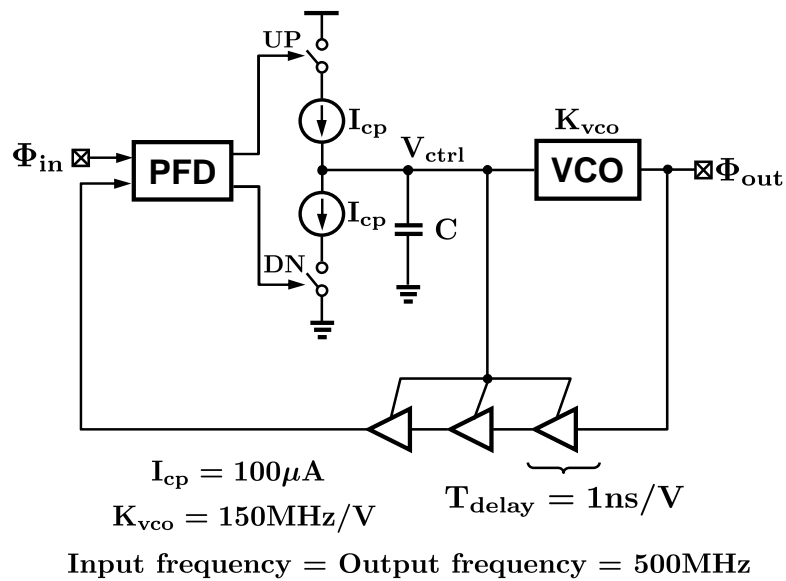
2. (35 points) _____

3. (15 points) _____

Total (90 points) _____

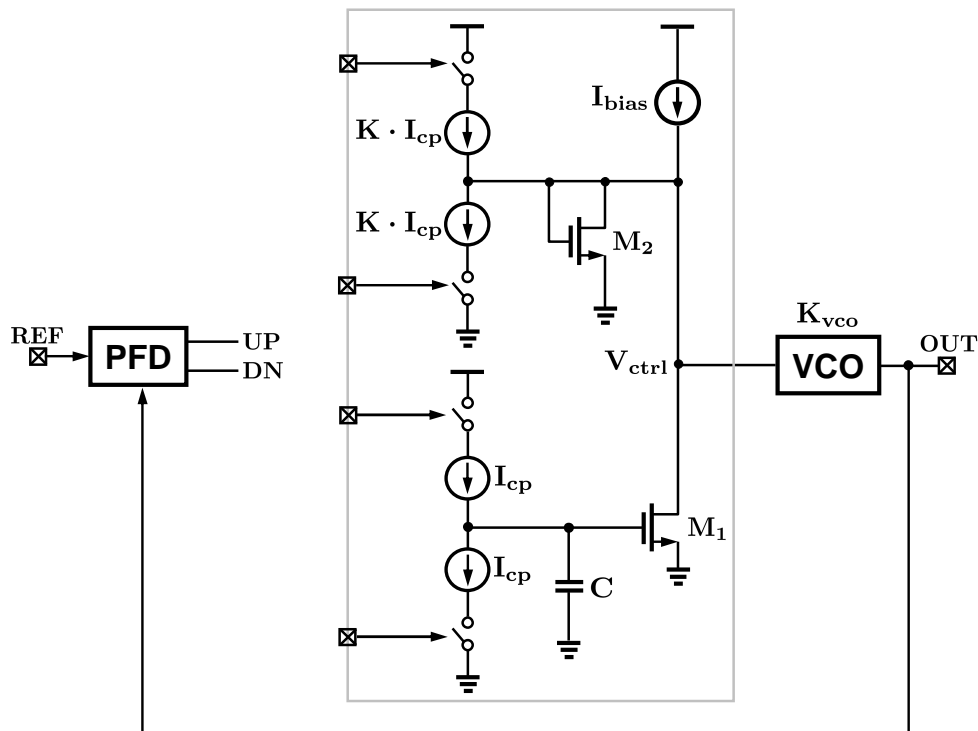
Good Luck!

PROBLEM 1. (40 points)



- (a) Draw the phase-domain steady-state block diagram. Specify the gain of each block with proper units. **(10 points)**
- (b) Find the expression for loop gain $LG(s)$ and determine the pole-zero locations of $LG(s)$. **(10 points)**
- (c) Determine the value of capacitor C to achieve loop-gain phase margin of 45° . **(10 points)**
- (d) Derive the expression for $H_{in}(s) = \frac{\Phi_{out}(s)}{\Phi_{in}(s)}$. **(10 points)**
- (e) Comment on the main difference between the above proportional control and the conventional proportional control using a resistor. **(Bonus: 5 points)**

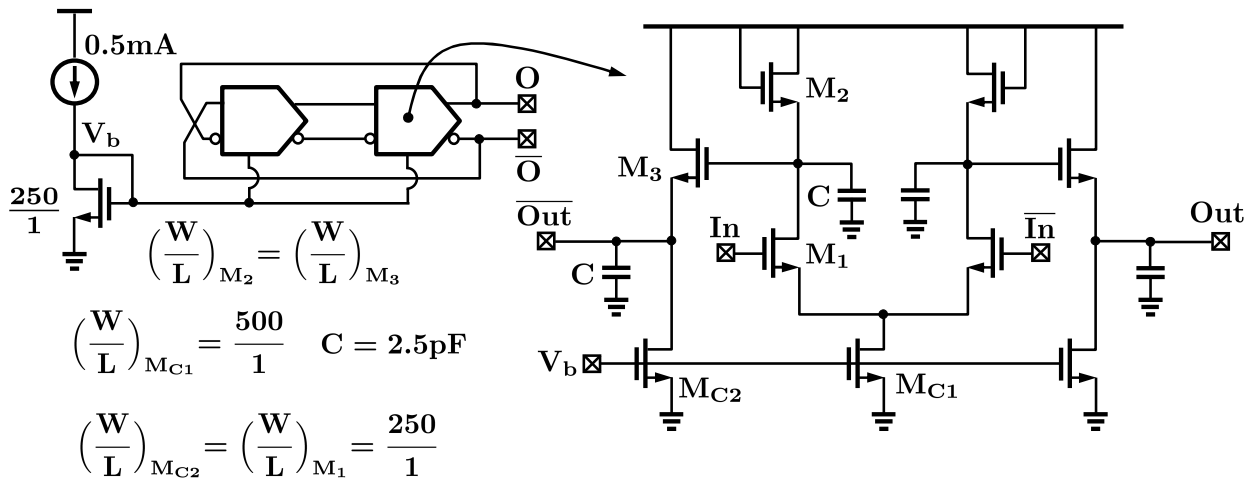
PROBLEM 2. (35 points)



- Connect the PFD outputs (UP/DN) appropriately to both the charge-pumps to realize the loop-stabilizing proportional-integral control. **(10 points)**
- Draw the phase-domain steady-state block diagram. **(10 points)**
- Find the expression for loop gain $LG(s)$ and determine the pole-zero locations of $LG(s)$. **(10 points)**
- For minimizing the loop-filter area, should one choose $K > 1$ or $K < 1$ and why? **(5 points)**

Assume: All transistors in saturation region with $r_{ds} = \infty$, and ignore all intrinsic capacitances.

PROBLEM 3. (15 points)



- (a) Determine the sizes (W/L) of transistors M_2 and M_3 to achieve oscillations in the two-stage oscillator shown above. **(10 points)**
 Assume: All transistors in saturation region with $\mu_n C_{ox} = 100\mu\text{A}/\text{V}^2$, $r_{ds} = \infty$. Ignore all intrinsic capacitances and body effect ($g_{mb} = 0$).
- (b) Determine the oscillation frequency. **(5 points)**