

Time: 3 Hours

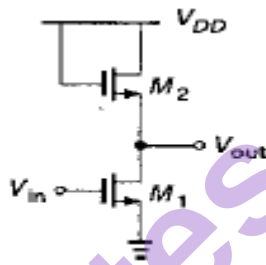
Max Marks: 80

- N.B. 1) Question No.1 is compulsory
2) Solve any three questions from the remaining questions.
3) Assume suitable data if necessary.

1 Solve any four of the following.

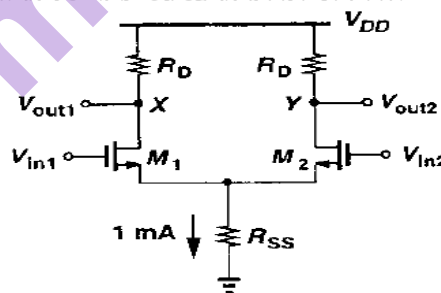
- Explain trade-offs in analog design with the help of analog design octagon 5
- For a n-channel MOSFET draw- a) a basic small signal model b) small signal model considering channel length modulation effect c) small signal model considering body effect 5
- Explain the concept of clock feed through in the MOSFET sampling circuit 5
- Compare performance of various op-amp topologies 5
- Derive expression for input referred noise of CS stage 5

2 (a) 10



Identify the above network. Derive the gain equation of the above circuit.

- Derive equation of differential gain, common mode gain and CMRR of a differential amplifier circuit. 10
- The following circuit uses a resistor rather than a current source to define a tail current of 1mA. 10

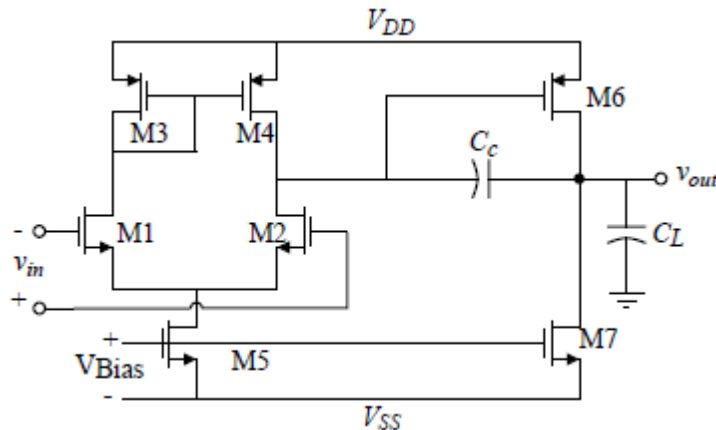


current of 1mA.

Assume $(W/L)_{1,2} = 25/0.5$, $\mu_n C_{ox} = 50 \mu A/V^2$, $V_{TH} = 0.6V$, $\lambda = 0$, $V_{DD} = 3V$

- What is the required input CM for which R_{SS} sustains 0.5V? 10
- Calculate R_D for a differential gain of 5
- What happens at the output if input CM level is 50mV higher than the value calculated in (a)?
- Derive expression for voltage gain A_v and output resistance R_o of source follower stage.

Q.4 Design two stage operational amplifiers that meet the following specifications 20



$A_v > 3000V/V$ $V_{DD} = 2.5V$ $V_{SS} = -2.5V$

Gain Bandwidth = 5MHz, Slew Rate $> 10V/\mu s$, 60° phase margin,

$0.5V < V_{out} \text{ range} < 2V$,

ICMR = -1.25V to 2V,

$P_{diss} \leq 2 \text{ mW}$, $C_L = 10pF$

Use $K_N' = 100\mu A/V^2$, $K_P' = 20\mu A/V^2$, $V_{TN} = |V_{TP}| = 0.5V$, $\lambda_N = 0.06V^{-1}$,
 $\lambda_P = 0.08V^{-1}$, $C_{ox} = 2.47fF/\mu m^2$.

Verify that the designed circuit meets required voltage gain and power dissipation specifications

- 5 (a) Explain the charge injection mechanism in MOS sampling circuits and also describe the errors contributed by the above effect. 10
- (b) What is a band gap reference? Describe methods of implementation of band gap references. 10
- 6 Write short note on any four
 - (a) Necessity of Millers theorem 5
 - (b) Gilbert Cell 5
 - (c) Charge Pump PLL 5
 - (d) Comparison of full custom design and semi custom design 5
 - (e) Performance parameters of VCO 5
