

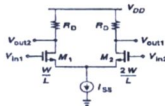
[Time: 3 Hours]

[Total Marks: 80]

Note: 1) Question ONE is compulsory

- 2) Solve any THREE out of remaining questions
- 3) Draw neat and clean diagrams, wherever necessary
- 4) Assume suitable data, if required

- 1 (a) Analyze following circuit to get voltage gain equation if  $M_2$  is twice wide as that of  $M_1$  and  $V_{in1} = V_{in2}$  5



- (b) Explain importance of Miller Theorem 5
  - (c) List the non-ideal effects in Charged Pump circuit and justify how it impacts the PLL performance 5
  - (d) With the help of suitable circuit diagram, Justify True or false: Cascode current mirror current matching performance is better than Basic current mirror. 5
- 2 (a) Derive expression for Voltage gain  $A_v$  and output resistance  $R_o$  of Source follower stage. 10
- (b) Explain in detail how to generate temperature independent references. 10
- 3 (a) Explain the concept of clock feed through in Charged Pump, Charge injection Charge Sharing in Charged Pump 10
- (b) Explain the concept of switched capacitor circuit. Draw and explain discrete time integrator along with the output waveform 10
- 4 (a) Explain common mode response of differential pair with necessary derivations 10
- (b) Explain White & Flicker noise in MOSFET. Derive equation for output and input referred noise voltage of CS stage 10

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- 5 Design two stage Operational Transconductance Amplifier (OTA) to meet following specifications- 20
- $A_v > 4000 \text{ V/V}$ ,  $V_{DD} = 2.5\text{V}$ ,  $V_{SS} = -2.5\text{V}$   $GBW = 6\text{MHz}$ ,  $C_L = 10\text{pF}$ ,  
 $SR > 10\text{V}/\mu\text{s}$ ,  $60^\circ$  phase margin,  $-2\text{V} \leq V_{out} \text{ range} \leq 2\text{V}$ ,  
 $ICMR = -1.125\text{V}$  to  $2\text{V}$ ,  $P_{diss} \leq 2.5\text{mW}$   
 Use,  $K_N = 110\mu\text{A}/\text{V}^2$ ,  $K_P = 50\mu\text{A}/\text{V}^2$ ,  $V_{TN} = |V_{TP}| = 0.7\text{V}$ ,  $\lambda_N = 0.04\text{V}^{-1}$ ,  
 $\lambda_P = 0.05\text{V}^{-1}$ ,  $C_{ox} = 2.47\text{fF}/\mu\text{m}^2$ . Verify that the designed circuit meets required Voltage Gain and Power Dissipation specifications.
- 6 (a) Give comparison between Full-custom and Semi-custom design 5  
 (b) Compare various opamp topologies 5  
 (c) Compare the performance of Ring and LC oscillators in terms of phase noise, area, Q factor and application. 5  
 (d) Derive the expression of input referred noise voltage of common source stage 5

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