

Time:- 3 hrs.

Marks:- 80

N. B.

1. Q.1 is compulsory.
2. Answer any **three** out of the remaining five questions.
3. Figures to the right indicate marks.
4. Answer to the questions should be grouped and written together.

- Q1. Solve **any four** out of **five** **5**
- a. What is the Over Drive Voltage and its Significance? **5**
  - b. Explain DAC Specifications. **5**
  - c. Compare common source, Common gate and common Drain Amplifier in brief. **5**
  - d. Draw a simple current mirror circuit with the power supplies  $V^+ = +5V$ ,  $V^- = 0V$ ,  $I_{REF} = 0.30mA$ ,  $I_o = 0.10mA$   
 $K_n = 40 \mu A/V^2$ ,  $V_{th} = 1V$ ,  $\lambda = 0$   
 Design the MOSFETs **5**
  - e. Explain various issues associated with Mixed Signal Circuit Layout.
- Q2. a. Explain the difference and common mode of MOSFET differential Amplifiers **10**
- b. For a NMOS Amplifier with driver (M1) with  $V_{in}$  as the input voltage and PMOS as a load (M2) with  $V_b$  as the input gate Voltage to the PMOS. The  $V_{DD} = 1.8V$ .  
 $\lambda_1 = 0.1 V^{-1}$ ,  $\lambda_2 = 0.15 V^{-1}$ ,  $\mu_n C_{ox} = 200 \mu A/V^2$ ,  $|V_{th}| = 0.4V$   
 The Amplifier should provide gain of 10 with bias current of 0.5mA.  
 Compute (W/L) of M1. **10**
- Q3. Find out the range of the differential input voltage for a MOSFET Differential Amplifier **10**
- b. Derive the Voltage Gain for CS Stage with Diode Connected Load. **10**
- Q4. Design a two stage Op-Amp for the following specifications **20**
- Design a two stage Op-Amp with a phase margin of 60 degree and channel Length =  $1 \mu m$   
 $A_v > 3500v/v$ ,  $V_{dd} = 2.5v$ ,  $V_{ss} = -2.5v$ , Gain Bandwidth = 6MHz  
 $C_{load} = 10pf$ , SR. 10 V/us,  $V_{out}$  range = +2 to -2 v ,  
 $ICMR = -1.125 V$  to +2V , Power Dissipation < 2mw
- $\epsilon_0 = 8.854 \times 10^{-14} F/cm$   
 $\epsilon_{si} = 11.7 \epsilon_0 F/cm$   
 $\epsilon_{ox} = 3.9 \epsilon_0 F/cm$   
 Threshold Voltage (NMOS) = 0.7V  
 Threshold Voltage (PMOS) = - 0.7V  
 Channel length modulation index (NMOS) =  $0.04 V^{-1}$   
 Channel length modulation index (PMOS) =  $0.05 V^{-1}$

Q5. a. Explain CASCODE Amplifier in general with the help of AC equivalent circuit. **10**  
Also draw the CASCODE Amplifier with CASCODE Load and Explain its Voltage gain and output Resistance.

b. For a common Source Amplifier, explain the relation between the transconductance  $v/s$  input voltage. **10**

Q6. **Write short notes on**

a. Successive Approximation method ADC **5**

b. Noise in MOSFETs. **5**

c. CMOS band gap reference generator. **5**

d. Triple CASCODE circuit **5**

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