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# P.E.S. College of Engineering, Mandya - 571 401

***(An Autonomous Institution affiliated to VTU, Belagavi)***

**Sixth Semester, B.E. - Electronics and Communication Engineering**

**Semester End Examination; June - 2017**

**Analog CMOS VLSI Design**

*Time: 3 hrs* *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
*ii) Assume missing data suitably.*

**UNIT - I**

1. a Starting from fundamentals derive the equation for drain current of MOS device. Modify the equation for the device operating in triode region and saturation region. 8

   b. Write a note on body effect. 4

   c. For a common source stage with source degeneration, obtain the expression for $A_V$ taking body effect and channel length modulation into account. 8

2 a. For a source follower, obtain the expression for $A_V$ using large signal model. Verify the result using small signal model. 10

   b. For a common gate amplifier derive the expression for Av taking body effect, channel length modulation and input source resistance into account. 10

**UNIT - II**

3 a. Using the quantitative approach obtain the expression for voltage gain of a differential pair. 10

   b. Discuss the common move response of a differential amplifier :

   i) In the presence of resistor mismatch 10

   ii) With finite tail capacitance.

4 a. For a differential amplifier with current mirror as the load, obtain the expression for Av. 10

   b. Discuss the operation of cascade current mirror. 10

**UNIT - III**

5 a. Discuss the operation of circuit that provides supply-independent current. Show that

$$I_{out} = \frac{2}{M_n C_{ox}\left(\frac{W}{L}\right)_N} \cdot \frac{1}{R_s^2}\left[1-\frac{1}{\sqrt{k}}\right]^2 .$$ 10

   Also discuss how startup problem is eliminated?

   b. Discuss the generation of temperature independent voltage. How the effect of Op-Amp off-set is reduced? 10

6. a For a unity gain sampler operating in amplification mode, obtain the expression for $\frac{V_o(s)}{V_i(s)}$ and $\tau_{amp}$. 10

Contd….2

b. Write note on the following :

i) Switched-Capacitor integrator 10

ii) Switched-Capacitor common mode feedback.

**UNIT - IV**

7 a. For a three stage ring oscillator, obtain the expression for frequency of oscillations and minimum gain for sustained oscillations. Plot the poles for $0 < A_0 < 2$, $A_0 = 2$ and $A_0 > 2$. 10

b. For a Colpitts oscillator, obtain the expression for frequency of oscillations and minimum gain for sustained oscillator. 10

8a. Discuss two methods to generate negative resistance that can be used in oscillator circuit. 10

b. What is VCO? Briefly explain the important performance parameters of VCO. 10

**UNIT - V**

9 a. Discuss the response of PLL to frequency step and phase step. 10

b. For a type-I PLL obtain the expression for closed loop transistor function obtain the response for step input when the PLL is under damped. 10

10a. Obtain the linear mixer of charge pump PLL and discuss. 10

b. Discuss any two applications of PLL. 10

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