Hall Ticket Number:

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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

M.E. (ECE: CBCS) I-Semester Main Examinations, Jan./Feb.-2017

(Embedded Systems & VLSI Design)

Analog IC Design

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. What are the various biasing techniques employed in CMOS analog circuits?
2. What are the constraints in incorporating inductors into ICs?
3. Compare Wilson and Cascode current mirror circuits.
4. Describe threshold voltage based reference circuits.
5. In a common source amplifier with active load the transistors have W/L = (100μm) / (1.6μm), $\mu_n C_{ox}$ = 92 μA/ V^2, $\mu_p C_{ox}$ = 30 μA/ V^2, I_{bias} = 100μ A, V_{tn} = 0.8V and $r_{ds\text{-}n}$ (Ω) = [8000 L (μm)] / [I_D (mA)] and $r_{ds\text{-}p}$ (Ω) = [12000 L (μm)] / [I_D (mA)]. Calculate the gain of the stage.
6. What is output voltage swing? What are the swing problems in Amplifiers?
7. Define input basis current, CMRR and PSRR of an Op-Amp.
8. Draw the equivalent circuit of an op-Amp.
9. Classify oscillators.
10. In a four stage differential ring oscillation what is the minimum required voltage gain per stage. How many signal phases are provided by the circuit?

Part-B (5 × 10 = 50 Marks)

11. a) Explain the current source self biasing technique. [5]
    b) Explain the MOSFET characteristics needed to perform analog functions. [5]
12. a) What is Cascode current mirror? [5]
    b) For a Cascode current minor using nMOSFETs I_{in} = 100μA, each transistor has W/L = (100μm) / (1.6μm). Given that $\mu_n C_{ox}$ = 92 μA/ V^2, V_{tn} = 0.8V and r_{ds} = [8000 L (μm)] / [I_D (mA)]. Find r_{out} for the current mirror. Assume $g_s = 0.2\ g_m$ [5]
13. a) Derive the expression for the Voltage Gain of a common drain amplifier. [5]
    b) Derive the expression for the voltage gain of a differential input single ended output differential amplifier. [5]
14. a) What is a common mode feedback circuit? [4]
    b) Discuss the operation of a folded Cascode Op-Amp. [6]
15. a) Draw the circuit diagram of a Colpitts oscillator. Give the equivalent circuit. Derive the expression for frequency of oscillators. [6]
    b) Define tuning range and centre frequencies of a VCO. [4]

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16. a) Mention the various layers of BJT in ICS. [4]

    b) Draw the small signal high frequency model of MOSFET. Discuss the significance of parameters in model. [6]

17. Write short notes on any *two* of the following:

    a) Noise in amplifiers [5]

    b) Three stage Op- Amp [5]

    c) Ring Oscillators. [5]