Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(ECE-VLSI)/SEM-2/MVLSI-203/2013

2013

ANALOG IC DESIGN

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer Q. No. **1** and any *four* from the rest. 5 × 14 = 70

GROUP – A

1. Answer the following questions :

   a) What are the advantages of MOSFET resistor ? 3

   b) Explain the characteristics of an ideal current sink. 2

   c) Describe how a MOSFET can work as a Diode. 2

   d) Explain how a combination of switches and capacitors can be used to emulate a resistor. 3

   e) Describe the velocity saturation and channel length modulation in a *n*-MOS structure. 2

   f) What is a Phase Locked Loop ? Mention two uses of it. 2

GROUP – B

Answer any *four* questions. 4 × 14 = 56

2. Explain the basic operation of a two-stage Open loop Comparator. Design an Integrator circuit using Switched capacitor configuration and describe its operation. 7 + 7

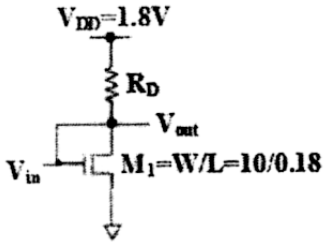
3. Explain the operation of a Differential amplifier with a current mirror load. How can a MOS device be used as a Voltage reference ? Explain the operation of a Band-Gap voltage reference source in a VLSI circuit. 5 + 4 + 5

4. Draw the circuit diagram of dual slope A/D converter and explain its operation. Discuss the merits and demerits of Flash ADC. Find the resolution for a DAC, if the output voltage is desired to be changed by 1 mV step-size with a reference voltage of 5 V. 7 + 3 + 4

5. Write a short note on how MOSFET can work as current sink and source. How to improve the performance of a simple NMOS current sink by connecting a resistance between source and ground ? 6 + 8

6. Design and explain the MOSFET switch model. Why subthreshold region operation has become very popular for analog VLSI circuits ? Explain the importance of g_m / I_d and intrinsic gain in sub-micron analog circuits. 3 + 3 + 8

7. Design a small signal equivalent circuit of a MOSFET. Explain how MOSFET can be used as a diode and compare it with a conventional *P-N* junction diode. Calculate the small signal voltage gain of CS stage shown in the figure below, $I_D = 1\,\text{mA}$, $\mu_n C_{ox} = 100\,\mu\text{A/V}^2$, $V_{th} = 0 \cdot 5\,\text{V}$ and $\lambda = 0$. Verify that M_1 operates in saturation.



3 + 5 + 6

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