Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH(ECE-OLD)/SEM-2/MC-201/2012

2012

RF MICROELECTRONICS AND VLSI 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.

GROUP – A

(Short Answer Type Questions)

Answer any *five* of the following questions : $5 \times 2 = 10$

1. a) Calculate the threshold voltage (V_{thlNV}) of CMOS inverter, where $V_{DD} = 5V$, V_{To}, $n = 1{\cdot}0$ V

$V_{To}, p = -1.0V$ and $K_r = 2 \cdot 5$.

b) Find the small signal output resistance (r_{out}) of a current sink circuit, where $\lambda = 0 \cdot 04$ and $I_d = mA$.

c) Define sensitivity of an RF receiver and write the expression of noise figure.

d) In an RF circuit, what is Gain compression due to non-linear effect ?

e) What do you mean by co-channel interference in mobile RF communication system ?

f) For an RF receiver circuit, find the value of "spurious-free dynamic range (SFDR)" where NF = 9dB, Piip3 = – 15dBmB=200kHz, SNR_{min} = 12dB.

g) What is pre-charge-evaluate logic ?

GROUP-B

(Long Answer Type Questions)

Answer any *five* of the following questions :

5 × 12 = 60

2. a) Explain that 'RF section' is still the design bottleneck of wireless communication system.

b) Write down the applications of RF technology. 7 + 5

3. a) Discuss the different types of non-linear effects of RF circuits.

b) What is intersymbol interference (ISI) ? Explain it.

7 + 5

4. a) What do you mean by channel length in MOSFET ?

   b) Draw the circuit diagram of CMOS inverter and explain its operation using VTC curve.

   c) Derive the expression for inverter threshold voltage for CMOS inverter.

$$V_{thlNV} = \frac{VTo_n + \sqrt{\frac{k_p}{k_n}}\, V_{DD} + VTo_p}{1 + \sqrt{\frac{k_p}{k_n}}}$$

2 + 5 + 5

5. a) What is the difference between full-custom design flow and semi-custom design flow ?

   b) Describe CMOS *n*-well process.

   c) Design a static CMOS logic to implement the Boolean function $F = AB + AB'C$. 3 + 5 + 4

6. a) Explain Domino CMOS logic.

   b) Describe the advantages of Transmission gate logic.

   c) What is the main problem with Dynamic CMOS logic ?

5 + 5 + 2

7. a) Define the following parameters of the mobile RF communication system :

   (i) Co-channel interference

   (ii) Hand-off

   (iii) Path loss and Multipath fading.

   b) Discuss different types of non-linear effects of RF circuits. 6 + 6

8. Write short notes on any *two* of the following : 6 + 6

   (i) CMOS differential amplifier

   (ii) Cascade amplifier

   (iii) Simplified VLSI Design Flow

   (iv) 'MOSFET' as a switch.