

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.*

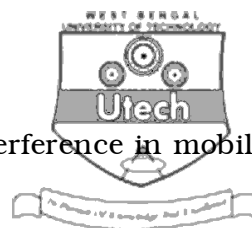
**GROUP – A**

**( Short Answer Type Questions )**

Answer any *five* of the following questions :

$$5 \times 2 = 10$$

1. a) Calculate the threshold voltage ( $V_{thINV}$ ) of CMOS inverter, where  $V_{DD} = 5V$ ,  $V_{To}$ ,  $n = 1.0$  V  
 $V_{To,p} = -1.0V$  and  $K_r = 2.5$ .
- b) Find the small signal output resistance ( $r_{out}$ ) of a current sink circuit, where  $\lambda = 0.04$  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  $NF = 9\text{dB}$ ,  $P_{iip3} = -15\text{dBm}$ ,  $B = 200\text{kHz}$ ,  $SNR_{\min} = 12\text{dB}$ .
- g) What is pre-charge-evaluate logic ?

### GROUP-B

#### (Long Answer Type Questions)

Answer any *five* of the following questions :

$$5 \times 12 = 60$$

- 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.

$$V_{thINV} = \frac{V_{To_n} + \sqrt{\frac{k_p}{k_n}} V_{DD} + V_{To_p}}{1 + \sqrt{\frac{k_p}{k_n}}}$$

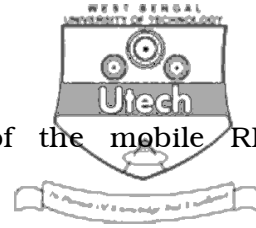
2 + 5 + 5

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.
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