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CS/M.TECH(ECE-OLD)/SEM-2/MC-201/2011

2011

RF MICROELECTRONICS & 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 the following questions. 5 × 2 = 10

1. In an RF circuit, find out the value of '1-dB compression point' due to non-linear effect.

2. For an RF receiver circuit, find the value of 'spurious-free dynamic range (SFDR)' where NF = 9dB, P_{iip3} = – 15 dBm, B = 200 kHZ, SNR_{min} = 12 dB.

3. Calculate the threshold voltage (Vth) of a CMOS inverter, where V_{DD} = 5V, $V_{To,n}$ = 1.0V, $V_{To,p}$ = – 1.0V and Kr = 2.5.

4. Draw the circuit diagram of a clocked NOR based 'SR latch' circuit (using CMOS logic).

5. For a current sink circuit, find out the small signal output resistance (r_{out}), where $\lambda = 0.04$ and $I_d = 0.1$ mA.

GROUP – B

(Long Answer Type Questions)

Answer any *four* of the following. 4 × 15 = 60

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

   b) Write down the applications of the RF technology.

   c) In a digital transmitter or receiver system which part is related with RF electronics ? 7 + 5 + 3

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

   b) What is Inter Symbol Interference (ISI) ? Explain it.

   10 + 5

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

      i) Co-channel interference

      ii) Hand-off

      iii) Path-loss and multipath fading

      iv) Diversity.

b) What is the difference between Heterodyne and Homodyne receivers ?

c) In the Hartley architecture, calculate relative gain imbalance. 8 + 4 + 3

9. a) Discuss the basic fabrication steps of MOSFET.

b) Describe CMOS n-Well process.

c) What is the difference bewteen full-custom design flow & semi-custom design flow ? 8 + 4 + 3

10. a) State the operation of CMOS inverter and calculate the Vth of the CMOS inverter.

b) What is the difference between Dynamic and Domino CMOS logic ?

c) Describe the advantages of Transmission-gate (TG) logic. (5 + 3) + 4 + 3

11. a) State the operation of the CMOS differential amplifier using current mirror load.

b) State the operating principle of an MOS diode.

c) State the advantages of CMOS when it is acted as a switch. 7 + 5 + 3

12. Write short notes on any *three* of the following : 3 × 5

i) Current Sink circuit

ii) Cascode amplifier

iii) Simplified VLSI design flow

iv) 'MOSFET' as a switch

v) High efficiency power amplifier.