

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013**

**Subject Code: 712602N****Date: 26-12-2013****Subject Name: CMOS Circuit Design-I****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1 (a)** Draw the equivalent CMOS inverter circuit for Low to High transition and high to low transition. Also prove that if CMOS inverter is switched ON and OFF  $f$  times per second, the dynamic power consumption is **07**

$$P_{\text{dyn}} = C_L V_{DD}^2 f$$

**(b)** Discuss importance and impact of scaling in VLSI and compare full scaling and fixed voltage scaling in detail. **07**

**Q.2 (a)** Discuss Manchester carry –chain adder. **07**

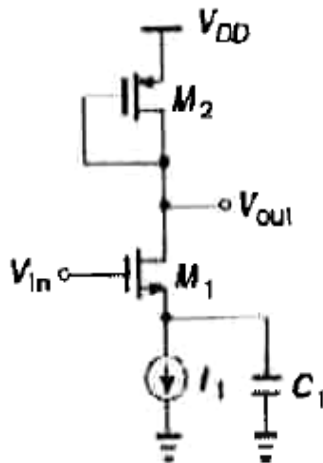
**(b)** Explain carry save multiplier. **07**

**OR**

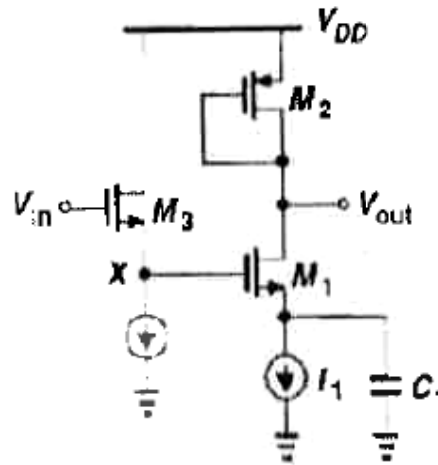
**(b)** Discuss Dynamic Threshold scaling (DTS) to reduce power consumption. **07**

**Q.3 (a)** Draw source follower circuit and its small signal equivalent circuit. Derive voltage gain  $A_V$  and output resistance  $R_{OUT}$ . **07**

**(b)** As shown in circuit (a), calculate the voltage gain if  $C_1$  acts as an ac short at the frequency of interest. **07**



(a)



(b)

I) What is the maximum dc level of the input signal for which M1 remains saturated?

II) To accommodate an input dc level close to  $V_{DD}$ , the circuit is modified as shown in (b). What relationship among the gate – source voltages of M1-M3 guarantees that M1 is saturated?

**OR**

**Q.3 (a)** Discuss Multipole Systems for stability and frequency compensation.. **07**

**(b)** Explain any two second order effects in detail. **07**

- Q.4 (a)** Discuss Gilbert cell Why Gilbert cell consumes a greater voltage headroom than a simple differential pair? **07**
- (b)** Discuss Qualitative analysis of differential pair. **07**
- OR**
- Q.4 (a)** Discuss frequency response of common source stage. **07**
- (b)** Draw high –frequency model of a cascade stage and explain. **07**
- Q.5 (a)** Explain the following: **07**
- (1) Basics of current mirror
- (2) Folded cascode
- (b)** Discuss basic cascode current mirrors. **07**
- OR**
- Q.5 (a)** Discuss simple op-amp topologies and cascade op-amps in brief. **07**
- (b)** Discuss following performance parameters of op-amp: **07**
- (1) Small Signal Bandwidth
- (2) Large Signal Bandwidth
- (3) Output Swing

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