UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2006/2007

October/November 2006

EEE 510 – ADVANCED ANALOGUE CIRCUIT DESIGN

Duration: 3 hours

Please check that this examination paper consists of SEVEN pages of printed material and ONE pages Appendix before you begin the examination.

This paper contains SIX questions.

Instructions: Answer **FIVE (5)** questions.

Answer to any question must start on a new page.

Distribution of marks for each question is given accordingly

All questions must be answered in English.

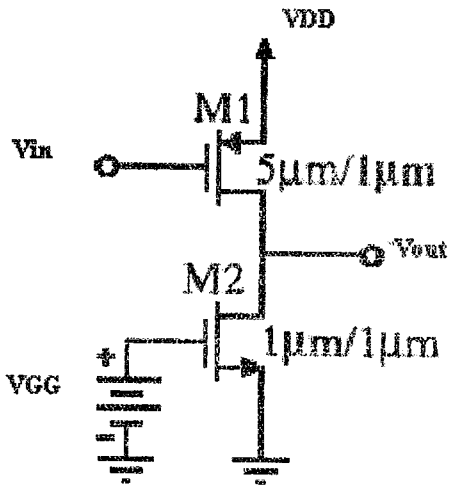

Figure 2 : Common source amplifier

2. A CMOS amplifier is shown in Figure 2. Assume M1 and M2 operate in the saturation region.

(a) What value of V_{GG} gives 100µA through M1 and M2? (6 marks)

(b) What is the DC value of input voltage V_{in}? (6 marks)

(c) What is the small signal voltage gain, V_{out}/V_{in}? (8 marks)

3. (a) Explain the advantages and disadvantages of differential amplifier over single common source amplifier.

(10 marks)

(b) Based on Figure 3, calculate output resistance, R_{out} and voltage gain when I_{ss}=10µA.

(10 marks)

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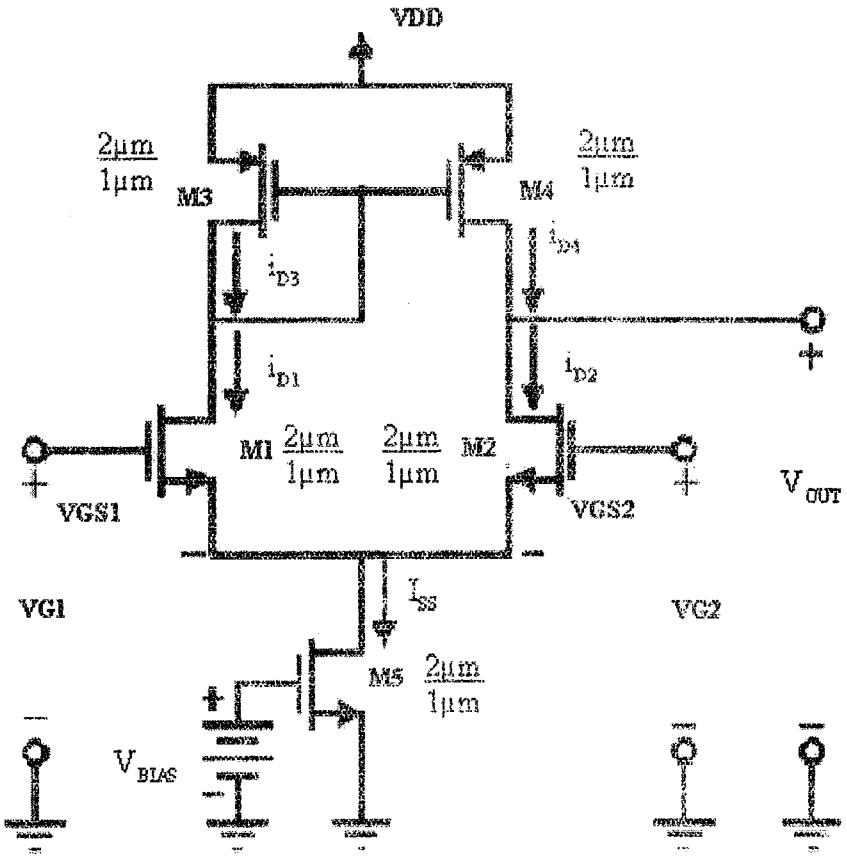

Figure 3 : Differential amplifier with single-ended output

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(b) Refer to Figure 6. Sketch I_X versus V_X as V_X varies for 0 to V_{DD}. (10 marks)

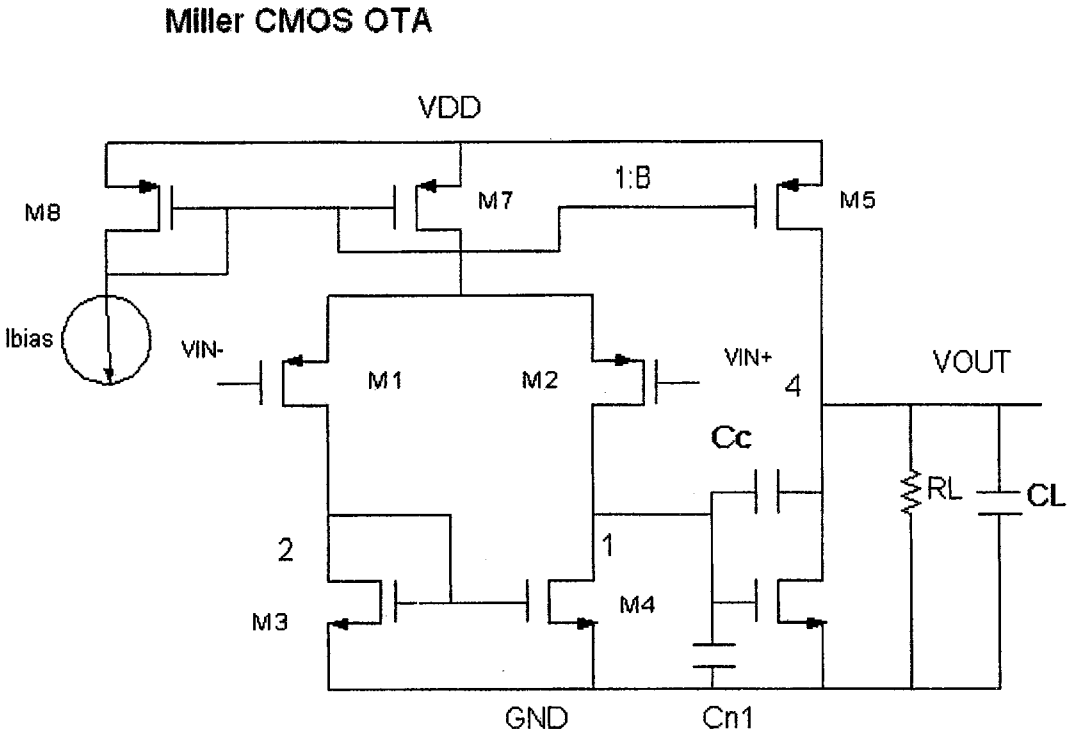

Figure 7

6. Derive the expression for

(a) Bandwidth (5 marks)

(b) Gain Bandwidth (10 marks)

(c) Non Dominant Pole (5 marks)

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Model Parameters for a Typical CMOS Bulk Process Suitable for Hand Calculations Using the Simple Model with Values Based on a 0.8 μm Silicon-Gate Bulk CMOS n-Well Process

Parameter Symbol	Parameter Description	Typical Parameter Value		Units
		n-Channel	p-Channel	
V_{T0}	Threshold voltage ($V_{BS} = 0$)	0.7 ± 0.15	−0.7 ± 0.15	V
K'	Transconductance parameter (in saturation)	110.0 ± 10%	50.0 ± 10%	$\mu A/V^2$
γ	Bulk threshold parameter	0.4	0.57	$V^{1/2}$
λ	Channel length modulation parameter	0.04 ($L = 1$ μm) 0.01 ($L = 2$ μm)	0.05 ($L = 1$ μm) 0.01 ($L = 2$ μm)	V^{-1}
$2\lvert\phi_F\rvert$	Surface potential at strong inversion	0.7	0.8	V