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UNIVERSITI SAINS MALAYSIA

First Semester Examination  
2015/2016 Academic Session

December 2015 & January 2016

**EEE 510 – Advanced Analogue Circuit Design**

Duration : 3 hours

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Please check that this examination paper consists of **SIX (6)** pages of printed material before you begin the examination.

**Instructions:** Answer **FIVE (5)** questions. Answer **TWO (2)** questions in Part A and **TWO (2)** questions from Part B and **ONE (1)** question from any section.

Use two-book answers for **Part A** and **Part B**.

All questions carry the same marks.

Part A : Answer TWO questions

1.

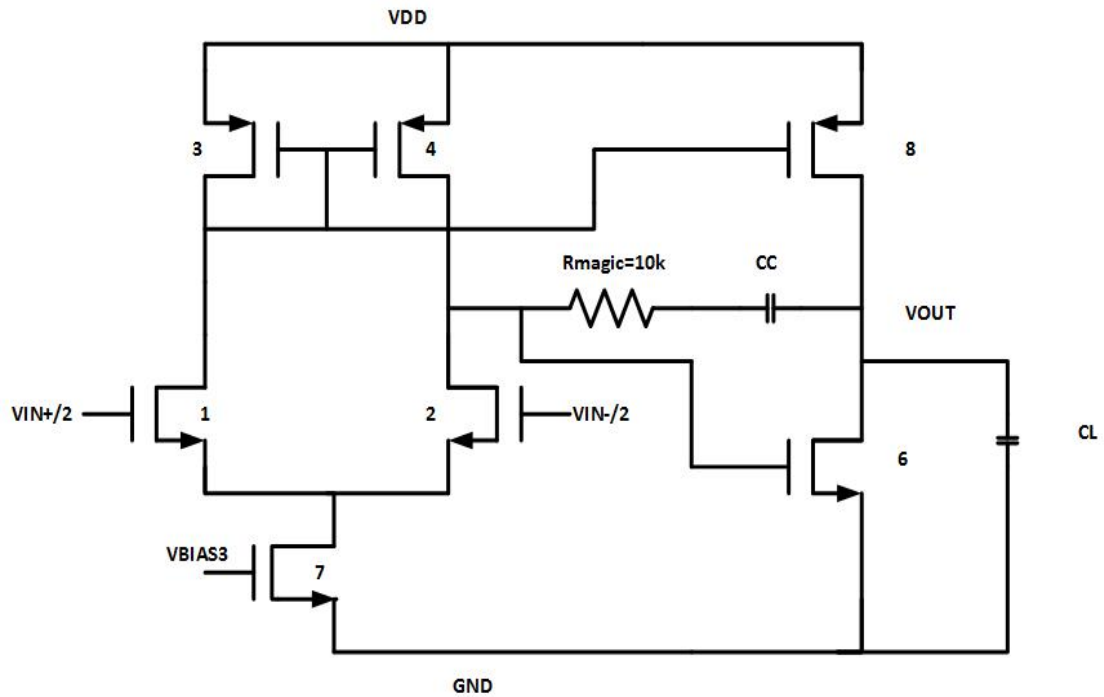


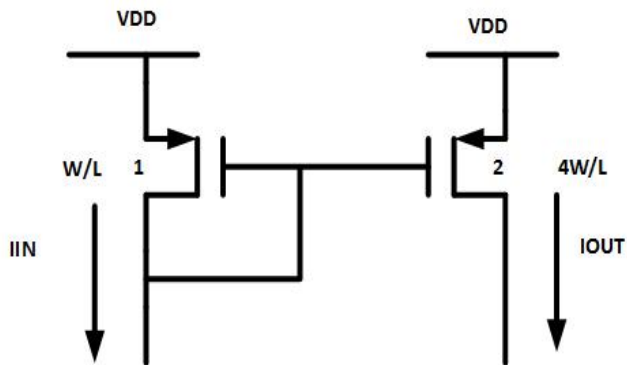
Figure 1

In Figure 1,  $C_{DG}$ ,  $C_{DB}$  and  $C_{GS}$  is 10 fF, 100 fF, 300 fF respectively.  $V_{DD}$  is 1.2 V,  $C_L = 1.0$  pF,  $C_C = 800$  fF,  $\lambda = 0.2$ . Drain current 7 perfect current source is  $200 \mu A$  and drain current 6  $400 \mu A$ .

- (a) Evaluate the dc gain. (4 marks)
- (b) Calculate the GBW. (10 marks)
- (c) Find the Phase Margin. (6 marks)



3. (a)



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Figure 3(a)

Derive the expression that link  $I_{IN}$  and  $I_{OUT}$ .

(4 marks)

(b)

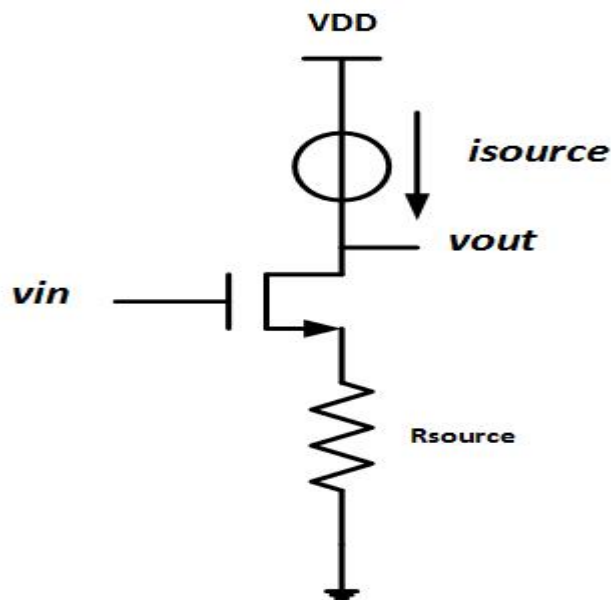


Figure 3(b)

Derive Output resistance and Transconductance of circuit Figure 3(b)

(16 marks)

...5/-

**Part B : Answer TWO question**

- 4. (a) By using a 3-bit example of DAC, explain the concept of LSB and DNL. (8 marks)
  - (b) Explain how a 6-bit weighted current source design can be developed based on a basic current source. Derive relevant equations to support your design. What are the advantages and disadvantages of this design? (12 marks)
5. Please refer Figure 5 for the following questions:

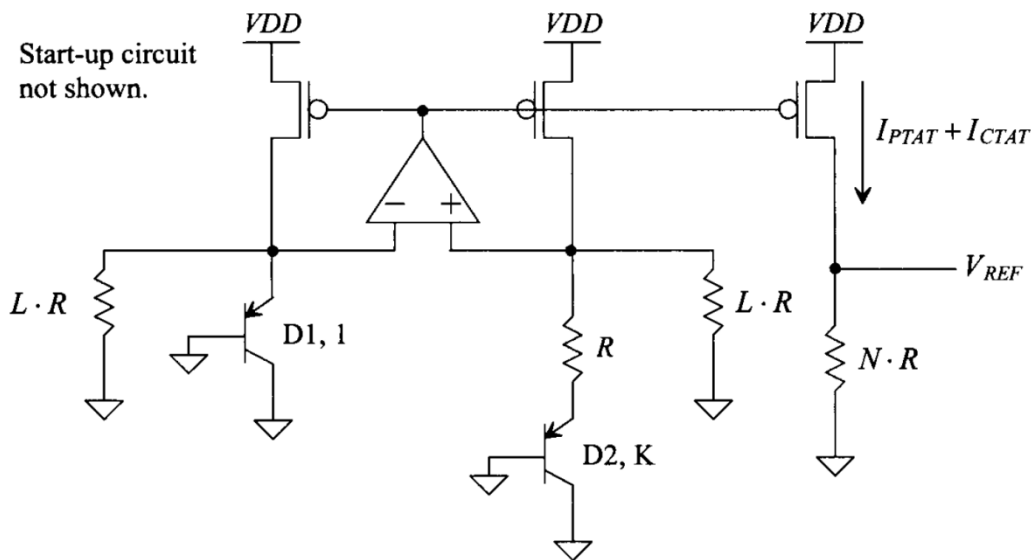


Figure 5 :  $V_{REF}$  Circuit

- (a) Explain the function of the operational amplifier. (4 marks)
- (b) Derive  $V_{REF}$ . (10 marks)

- (c) Based on equations from 5 (b), find the value of  $N$  if the  $V_{REF} = 0.9\text{ V}$ ,  $n = 1$  and  $K = 8$ .

(6 marks)

6. Please refer Figure 6 for the following questions:

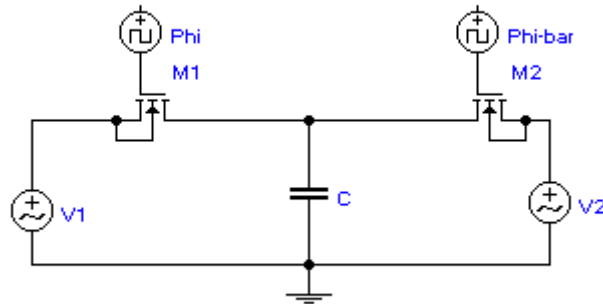


Figure 6 : Switched Capacitor (SC) Circuit

- (a) (i) Explain the function of MOSFET switches M1 and M2.
- (ii) Derive the equivalent resistance,  $R_{SC}$
- (b) Using a circuit in Figure 6, build a MOSFET PTAT current generator. Explain the circuit with the help of relevant equations. What are advantage and disadvantage of using SC circuit in this current generator.

(3 marks)

(5 marks)

(12 marks)