# 國立臺北科技大學產業研發碩士專班 96 年度秋季班招生考試

## 系所組別：110 電子電腦與通訊產業研發碩士專班

## 第一節 電子學 試題

第一頁 共一頁

---

**注意事項：**

1. 本試題共 5 題，配分共 100 分。

2. 請標明大題、子題編號作答，不必抄題。

3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

---

1. The operational transconductance amplifier (OTA) is a voltage-input current-output active device with the output current $I_o = Gm(V_+ - V_-)$, where Gm is the transconductance of the OTA, $V_+$ and $V_-$ are the voltages of positive and negative terminals of the OTA. If $V_i$ is the input and $V_L$ and $V_B$ are the outputs, find the transfer functions of $V_B/V_i$ and $V_L/V_i$ in the following second-order filter shown in Fig.1. (20 分)
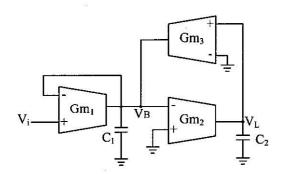


Fig.1

2. (a) Sketch the complete small-signal model of MOS transistor including the parasitic capacitors. (10 分)

   (b) Sketch the cross-section diagram of a CMOS p-well technology. (10 分)

   (c) What are the second-order effects of MOS transistor? Please explain them clearly. (10 分)

3. If the transconductances of $M_1$, $M_2$ and $M_3$ are $g_{m1}$, $g_{m2}$ and $g_{m3}$, and the output resistances of $M_1$, $M_2$ and $M_3$ are $r_{o1}$, $r_{o2}$ and $r_{o3}$, respectively, find the output resistance $R_{out}$ of the triple cascade circuit shown in Fig.2. (10 分)
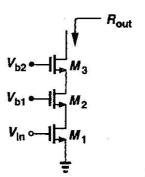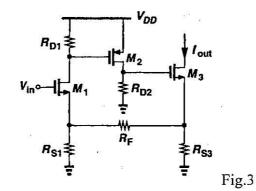


Fig.2

4. Neglecting the channel length modulation effect and the body effect, and assume that the transconductances of all MOS transistors are $g_m$, find the closed loop gain $I_{out}/V_{in}$ shown in the Fig.3. (20 分)



Fig.3

5. Sketch the block diagram of the dual-slope analog to digital converter and explain the operational principle. (20 分)