科目：**421** 電子學
系組：電機系電子組

考生注意：1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分。
3. 試題隨卷繳回。

(25%) 1. For Fig. 1, please prove that

$$I_{bias} = (V_T/R)\ln(I_{bias}/I_s)$$
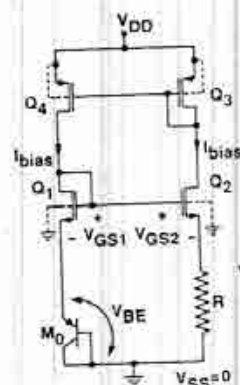
(for the bipolar transistor, $I_C = I_s e^{V_{BE}/V_T}$)

Fig. 1

(25%) 2. Please draw the small-signal equivalent circuit of the circuit shown in Fig. 2. Then derive its output resistance, $r_{out}$.
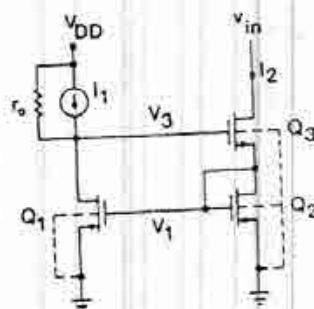
Fig. 2

(25%) 3. For the circuit shown in Fig. 3, please draw its small-signal equivalent circuit, and derive its differential-mode gain and common-mode gain.
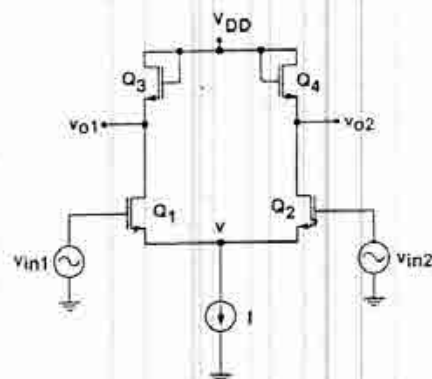
Fig. 3

(25%) 4. Please explain the following terms
(no more than 100 words for each term)

    (a) AFM     (b) Body Effect     (c) CVD     (d) Electromigration

    (f) Fermi Level     (g) Short Channel Effect     (h) OLED     (i) Tunneling Effect