

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, $I_C = I_s e^{V_{BE}/V_T}$)

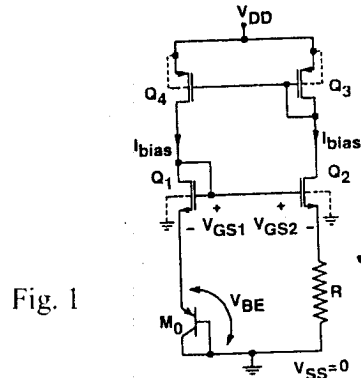


Fig. 1

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

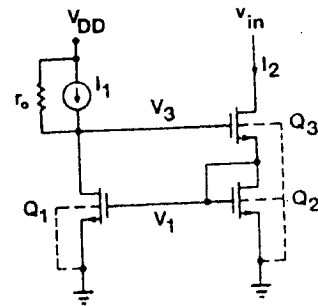


Fig. 2

(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.

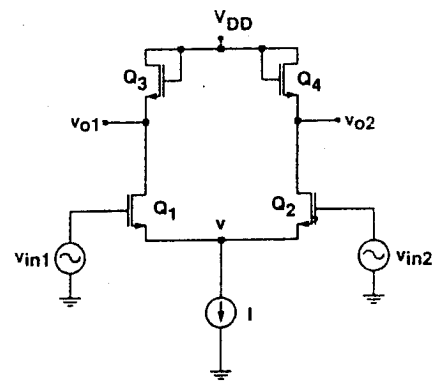


Fig. 3

(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