

國立中正大學
111 學年度碩士班招生考試
試題

[第 2 節]

科目名稱	電子學
系所組別	電機工程學系- 電磁晶片組 計算機工程組 晶片系統組

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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科目名稱：電子學

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系所組別：電機工程學系-電磁晶片組、計算機工程組、晶片系統組

4. For a silicon-based pn diode with cross-sectional area 10^{-4} cm^2 , the doping of p-side and n-side are $5 \times 10^{17} / \text{cm}^3$ and $5 \times 10^{16} / \text{cm}^3$, respectively. The intrinsic carrier concentration (n_i), the thermal voltage (V_T) and the dielectric constant at 300K are $1.5 \times 10^{10} \text{ cm}^{-3}$, 25.9 mV and $1.05 \times 10^{-10} \text{ F/m}$, respectively
- (a) To determine the carrier concentrations (p_p, n_p, n_n, p_n) on the both sides of pn diode.? (5%)
- (b) What's the built-in potential (V_0) over the junction. (5%)

5. Fig. P5 is a feedback transconductance amplifier. All the MOS transistors are operated at $|V_{ov}|=0.2\text{V}$ and with $|V_i|=0.5\text{V}$ and $|V_A|=20\text{V}$. The values of resistors R_S and R_F are $10 \text{ k}\Omega$.
- (a) If the M_1 gate is at zero dc voltage. Under negative feedback, what will be the gate voltage at M_2 ? (5%)
- (b) Please approximate the β value of feedback network. (5%)
- (c) Please determine the open-loop gain A . (5%)
- (d) Find the value of R_{out} . (5%)

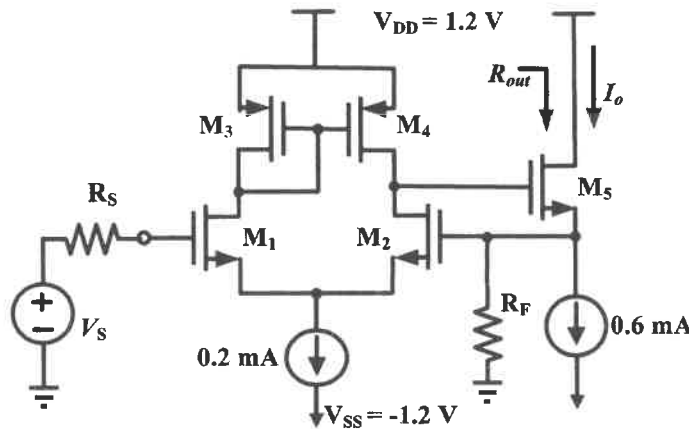


Fig. P5

6. Fig. P6 is a common-gate amplifier with current-mirror biased, all of the transistors are with $k_n = k_p = 5 \text{ mA/V}^2$, $|V_A| = 30 \text{ V}$, and $|V_t| = 0.8 \text{ V}$. R_S is 50Ω and v_{sig} just only plays as ac signal without dc component.
- (a) Estimating r_o for all transistors.? (5%)
- (b) What's the transconductance of M_1 with a prediction of over-drive voltage V_{ov1} ? (5%)
- (c) Finding the values of R_{in} ? (5%)
- (d) Finding the values of R_{out} ? (5%)

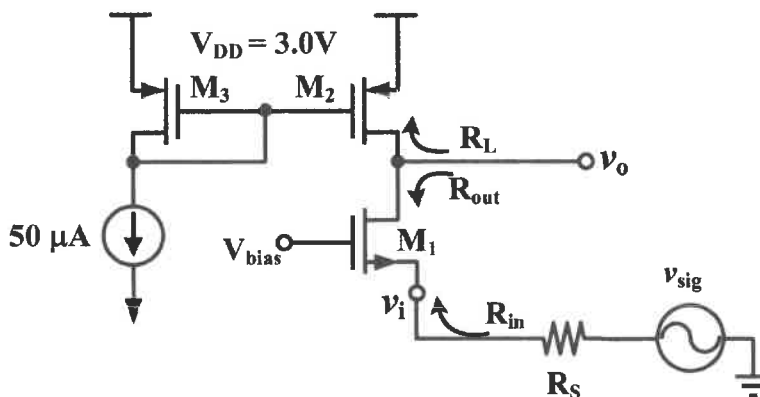


Fig. P6