國立中正大學
112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	機械工程學系光機電整合工程

—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。

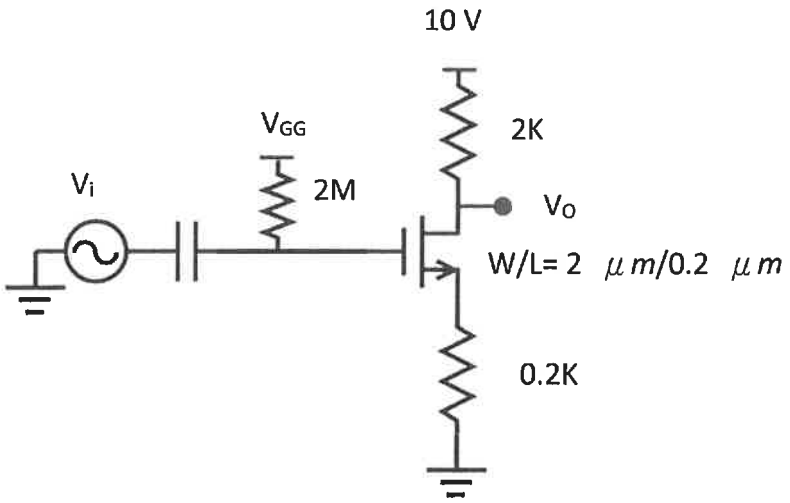
1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始40分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

國立中正大學 112 學年度碩士班招生考試試題

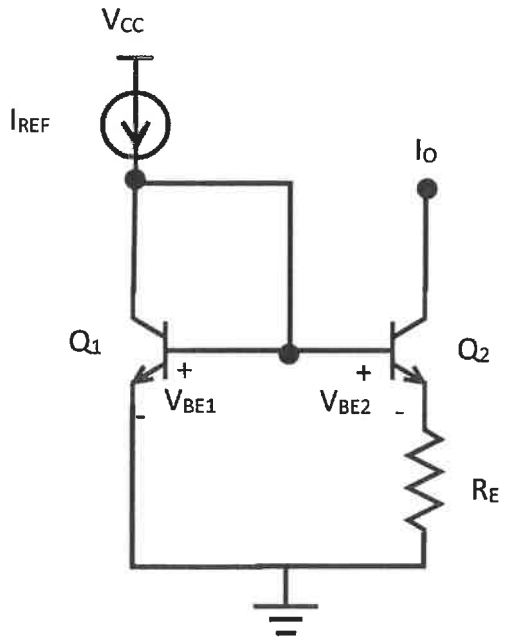
科目名稱：電子學　　本科目共 2 頁　第 1 頁

系所組別：機械工程學系光機電整合工程

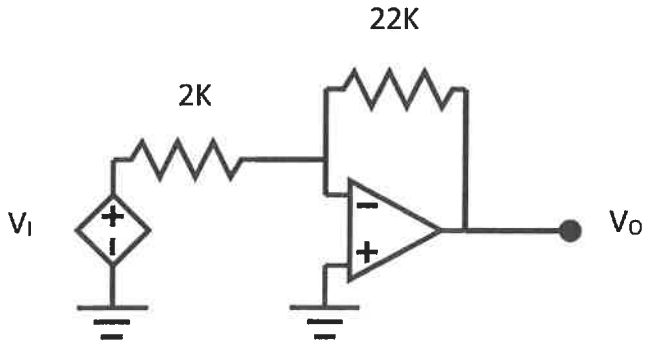
1. (25%) For circuit below, where V_{tn} (threshold voltage for NMOS) = | V_{tp} (threshold voltage for PMOS) | = 1 V, $\mu_n C_{ox} = 2\ \mu_p C_{ox} = 200\ \mu A/V^2$ (C_{ox} is the oxide capacitance, μ_n is the mobility of the electrons, and μ_p is the mobility of the holes), $V'_A = 40\ V/\mu m$ (V'_A is entirely process-technology dependent, as early voltage $V_A = V'_A L$).
   Let drain current $I_D = 2$ mA is desired, please find (a) (5%) V_{GG} (circuit below), (b) (5%) g_m (transconductance), (c) (5%) r_O (output resistance due to the Early effect), (d) (5%) R_O (output resistance), (e) (5%) A_V (voltage gain).



2. (25%) For circuit below, where thermal voltage $V_T = 25$ mV, $I_{REF} = 100\ \mu A$, $I_O = 20\ \mu A$, transistor parameters in current are $I_{S1} = I_{S2} = 5^{-15}$ A, please find (a) (5%) V_{BE1}, (b) (10%) V_{BE2}, (c) (10%) R_E



3. (25%) For circuit below, please find voltage gain A_V.



4. (25%) Consider the Hybrid π model for BJT, where voltage across the base–emitter junction $V_{BE} = 0.9$ V, transistor parameter $\beta_0 = 100$, thermal voltage $V_T = 25$ mV, voltage across the collector–emitter junction $V_{CE} = 0.4$ V, early voltage $V_A = 40$ V. Let quiescent collector current $I_C = 4$ mA, please find (a) (5%) transconductance g_m, (b) (5%) base resistance (r_π), (c) (5%) transresistance (r_m), (d) (5%) output resistance (r_O), and (e) (5%) output conductance (g_{CE}).