國立中央大學101學年度碩士班考試入學試題卷

所別：電機工程學系碩士班 固態組(一般生)　科目：電子學　共 2 頁 第 1 頁
電機工程學系碩士班 電波組(一般生)

本科考試禁用計算器　　＊請在試卷答案卷（卡）內作答

1. 計算題 (8 分)
   Find the output voltage, v_O, of the circuit shown in Fig. 1. The input voltages of this circuit are v_1 = 0.25 V and v_2 = 0.3 V.
2. 計算題 (12 分)
   A common-source amplifier with an ideal bias current source, I, is shown in Fig. 2. If the current source I = 1.67 mA, and used NMOS transistor M has V_{GS} =1.0 V, V_{DS} = 1.0 V, threshold voltage V_{tn} = 0.5 V, and λ = 0.01 V^{-1},
   2-1 (6 分) Find the output resistance r_o.
   2-2 (6 分) Find the voltage gain A_v.
3. 計算與問答題 (10 分)
   Fig. 3 shows a typical three-stage ring oscillator with identical transistors.
   3-1 (5 分) Find the required minimum voltage gain per stage for oscillation to start.
   3-2 (5 分) Find the phase shift per stage.
4. 計算題(10 分)
   Fig. 4 shows a current amplifier implemented by an ideal operational amplifier. Find the expression for the output current I_O.
5. 計算題(16 分)
   Fig. 5 shows the equivalent-circuit model of a common-source amplifier which is specified to have C_{gs} = 2 pF, C_{gd} = 0.1 pF, C_L = 1 pF, g_m = 5 mA/V, and $R_{sig} = R_L' = R_L // r_O$ = 20 kΩ.
   5-1 (2 分) Find the midband gain A_M.
   5-2 (6 分) Find the high-frequency 3-dB frequency f_H using the method of Miller approximation.
   5-3 (8 分) Find the high-frequency 3-dB frequency f_H using the method of open-circuit time constants.
6. 計算題 (16 分)
   Fig. 6 shows a differential amplifier which is operated with I = 0.1 mA, and the used transistors have V_A = 160 V and β = 100.
   6-1 (6 分) Find the differential input resistance.
   6-2 (6 分) Find the open-circuit voltage gain.
   6-3 (4 分) What will the approximate voltage gain be if the input resistance of the subsequent stage is 1.6 MΩ.
7. 計算題 (20 分)
   Fig. 7 shows a series-shunt feedback amplifier. The transistors are biased with the ideal current sources I_{B1} = 0.1 mA, and I_{B2} = 1 mA. The devices operate with V_{BE} = 0.7 V and have $\beta_1 = \beta_2$ =100 and infinite Early voltage. R_s = 100 Ω, R_1= 1 kΩ, R_2 = 10 kΩ, and R_L = 1 kΩ.
   7-1(5 分) If the loop gain is high enough, what do you expect the closed-loop gain V_o / V_s to be?
   7-2 (5 分) Find the input impedance R_{in}.
   7-3 (10 分) Find the exact closed-loop gain V_o / V_s.
8. 計算與問答題 (8 分)
   Fig. 8 shows a 5-bit charge-redistribution A/D converter in sample phase. If V_{REF} = 4 V and v_A = 1.5 V, which switches will be connected to V_{REF} at the end of conversion?

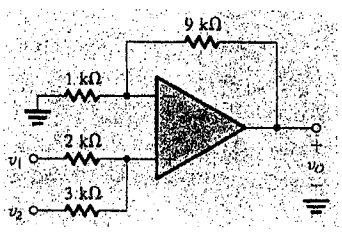

Fig. 1

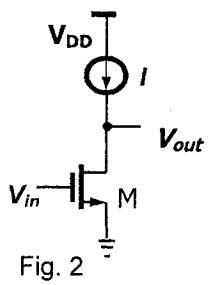

Fig. 2

注意：背面有試題

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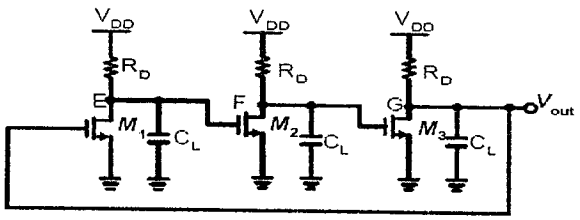

Fig. 3

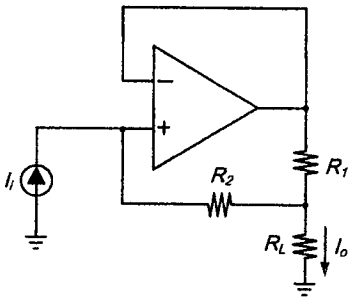

Fig. 4

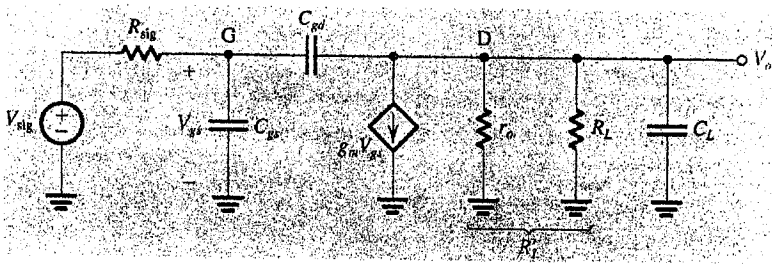

Fig. 5

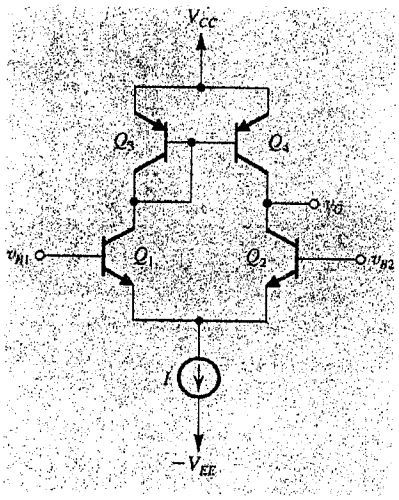

Fig. 6

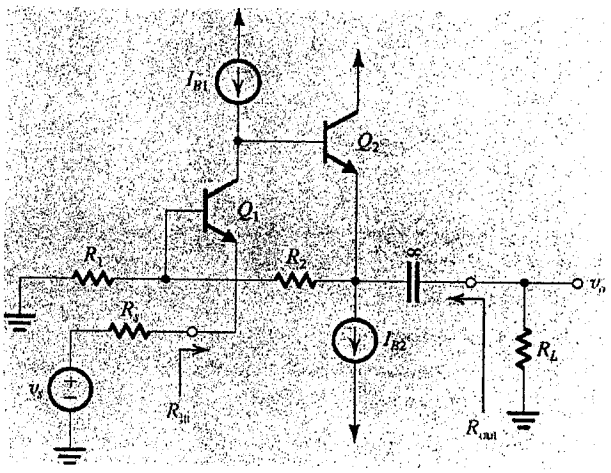

Fig. 7

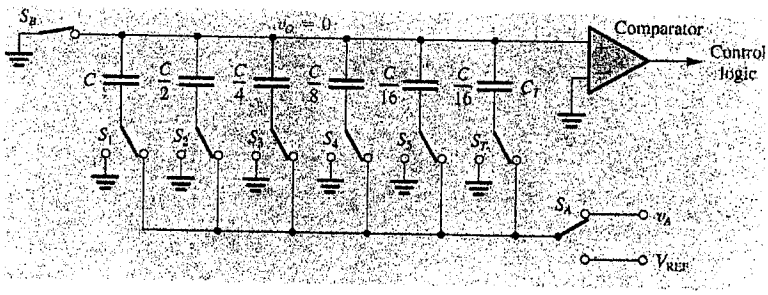

Fig. 8

注意：背面有試題