國立臺北科技大學 112 學年度碩士班招生考試

系所組別：2152 電機工程系碩士班戊組

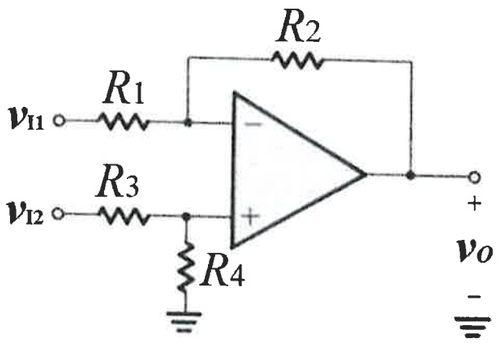
第一節　電子學　試題（選考）

注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

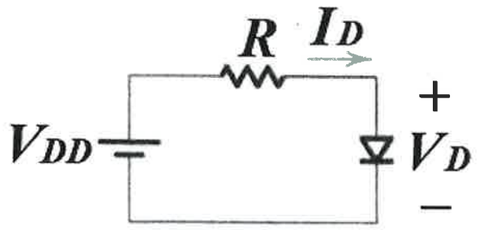
1. An amplifier operating from a single 15-V supply provides a 12-V peak-to-peak sine-wave signal to a 1-kΩ load and draws negligible input current from the signal source. The dc current drawn from the 15-V supply is 8 mA. What is the power dissipated in the amplifier (10%), and what is the amplifier efficiency? (10%)

2. Consider the difference amplifier circuit of a difference amplifier for the case $R_1 = R_3 = 2$ kΩ and $R_2 = R_4 = 200$ kΩ. (a) Find the value of the differential gain A_d (5%). (b) Find the value of the differential input resistance R_{id} (5%). (c) If the resistors have 1% tolerance (i.e., each can be within ±1% of its nominal value), find the worst case (minimum value) common mode gain A_{cm} (7%) and the corresponding value of CMRR (3%) with $A_{cm} = \left(\frac{R_4}{R_4 + R_3}\right)\left(1 - \frac{R_2}{R_1}\frac{R_3}{R_4}\right)$.



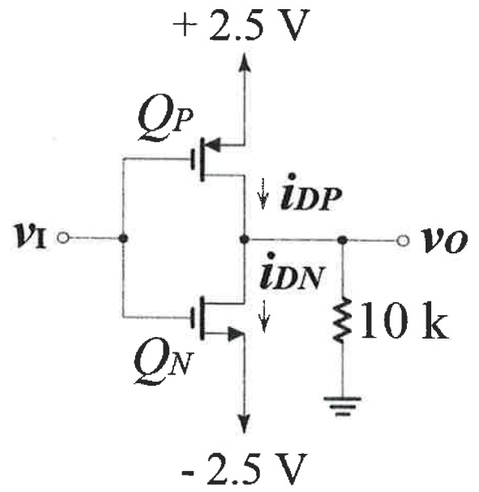
(2)

3. For the circuit in the following figure, find I_D and V_D for the case $V_{DD} = 5$V and $R = 10$ kΩ. Assume that the diode has a voltage of 0.7 V at 1-mA current and that the voltage changes by 0.1 V/decade of current change. Use (a) iteration (10%), (b) piecewise linear model with $V_{D0} = 0.65$ V and $r_D = 20$Ω (5%), (c) constant voltage drop model with $V_D = 0.7$V (5%).



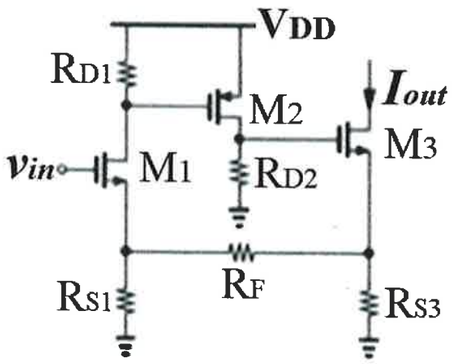
(3)

4. The NMOS and PMOS transistors in the following circuit are matched with $k_n'(W_n/L_n) = k_p'(W_p/L_p) = 1$ mA/V^2 and $V_{tn} = -V_{tp} = 1$V. Assuming $\lambda = 0$ for both devices, find the drain current i_{DN} and i_{DP}, as well as the voltage v_O, for $v_I = 0$ V (4%), +2.5 V (8%), and -2.5 V (8%).



(4)

5. Neglecting channel-length modulation and body effect, what is the transfer function ($G_{m,open} = I_{out}/V_{in}$)? (10%) and what is the close loop gain ($G_{m,\,closed}$)? (10%)



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