編號： 121

國立成功大學 109 學年度碩士班招生考試試題

系　　所：工程科學系

考試科目：電子電路

考試日期：0211，節次：1

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Mark each of the following statements True (T) or False (F). (Need NOT give reasons.) (20 pt.)

(a) Provided that the power supplied by the power plant is the same, while the supplied voltage changes from 350000 V to 175000 V. Assuming that the transmission line obeys the Ohm's law, the power dissipated in the transmission line reduces to a factor of 0.25.

(b) The small signal model of a Zener diode in the breakdown region is a DC voltage plus a resistor.

(c) The large signal model of a typical diode in the forward region can be approximated as a DC voltage plus a resistor.

(d) The input currents of ideal amplifiers are 0 because their open-loop gains are infinite.

(e) Typical diodes can function in the breakdown region irrespective of the current flowing through it.

(f) Differential amplifier can reject the common-mode input under all conditions.

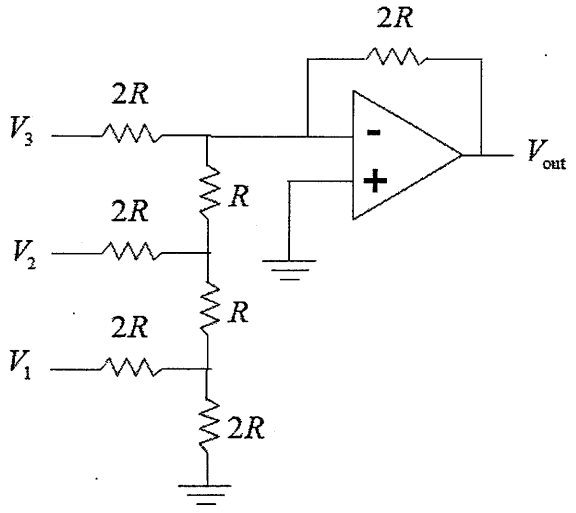
(g) Low-pass single-time-constant circuits mean that only signals with low amplitudes can be passed (or amplified) to the output.

(h) One of the advantages of a differential amplifier is that DC coupling can be applied in it.

(i) Doping intrinsic silicon with impurity atoms like a trivalent element forms *n* type semiconductor.

(j) At room temperature, there are no free electrons and holes in intrinsic silicon.

2. (a) Find V_{out}, when $V_1 = V_2 = V_3 = 5$ V. (b) Find V_{out}, when $V_1 = V_3 = 5$ V and $V_2 = 0$ V. (20 pt.)



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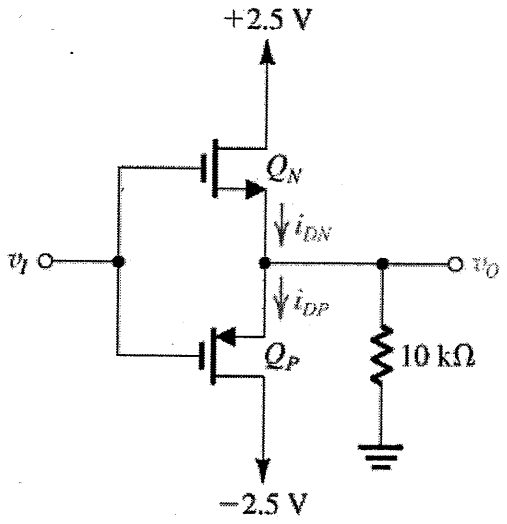
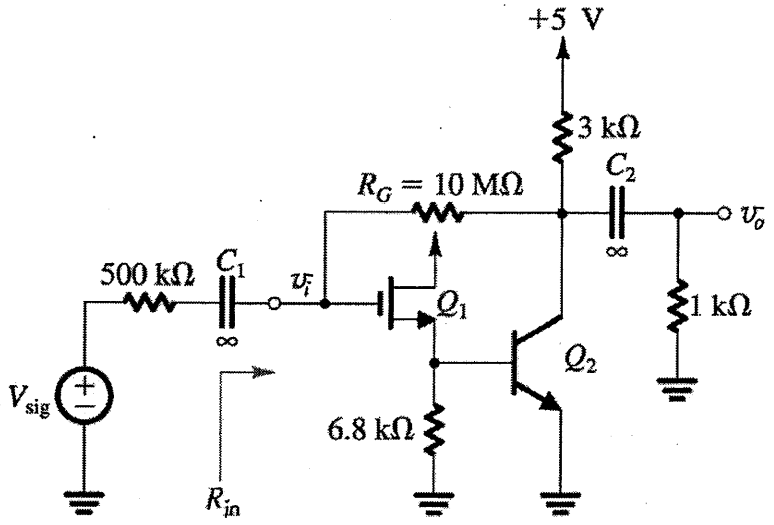
3. The NMOS and PMOS transistors are matched with $k_n'\left(W/L\right)_n = k_p'\left(W/L\right)_p = 1\ \text{mA/V}^2$ and $V_{tn} = -V_{tp} = 1\ \text{V}$. Besides, $\lambda = 0$ for both devices. Find i_{DN}, i_{DP}, and v_O for (a) v_I=0 V and (b) +2.5 V. (20 pt.)



4. (a) Consider the dc bias. Neglect the base current of Q_2. Assume the dc bias current in Q_1 is 100 uA, find the dc bias current in Q_2. (Assume $|V_{BE}|=|V_t|=0.7$ V, $\mu_n Cox(W/L)=2$ mA/V^2)

(b) Determine the voltage gain $A_v=v_o/v_i$. For this purpose you can neglect R_G. (20 pt.)



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5. For the circuit below, find the overall voltage gain v_o/v_i with $g_{m1}=g_{m2}=5\text{mA/V}$ and neglect r_o. (20 pt.)