系所組別：生物醫學工程學系乙組

考試科目：電子學　　　　　　　　　　　　　　　　　　　　　考試日期：0223，節次：1

※ 考生請注意：本試題不可使用計算機

1. A diode is made with following doping levels: $N_A = 10^{16}$ cm^{-3} and $N_D = 5 \times 10^{15}$ cm^{-3}. Assume the intrinsic carrier concentration in silicon at 300 K is 1.5×10^{10} cm^{-3}. Determine the hole and electron concentrations on the two sides, respectively. (20%)

2. In a full-wave rectifier experiment, a student wrongly swaps one of the diode as shown in Fig. 1. Point out the wrongly swapped diode (5%) and explain what happens (10%). (15%)
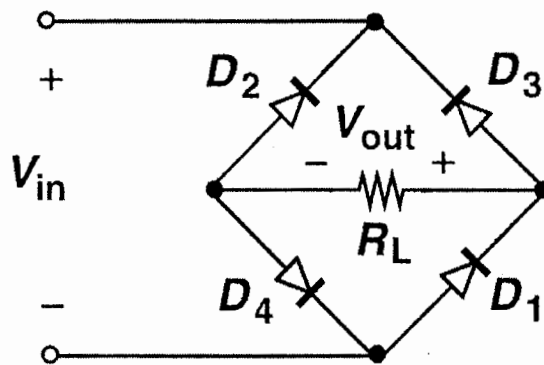

Fig. 1

3. A voltage controlled current source is shown in Fig. 2 with the $K = 20$ mA/V. (a) Determine the value of R_L which is necessary to achieve a voltage gain of 15, and (b) If a resistance of R_S is placed in series with the input voltage source, determine V_{out} / V_{in}. (20%)
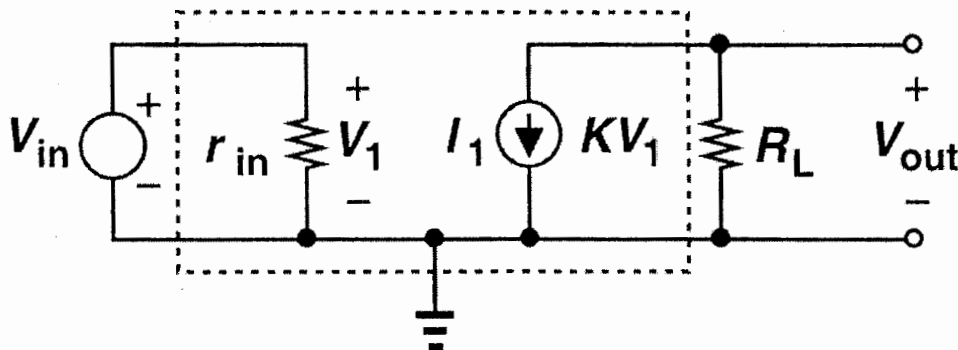

Fig. 2

（背面仍有題目，請繼續作答）

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4. Determine the input and output poles of the circuit as shown in Fig. 3 using Miller's theorem. Assume V_A is infinitely large and neglect other capacitances. (20%)
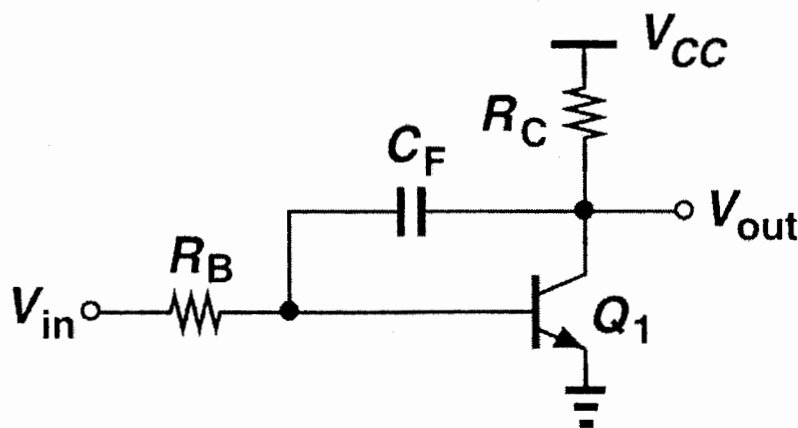

Fig. 3

5. Draw the circuit for an operational amplifier based logarithmic amplifier (5%), and explain with equations (10%). (15%)

6. Describe the concept of virtual ground for ideal operational amplifier. (10%)

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