

系所組別：醫學工程研究所乙組

考試科目：電子學

考試日期：0307，節次：1

※ 考生請注意：本試題 可 不可 使用計算機

1. An operational amplifier is operated from ± 15 V power supplies. A sinusoidal voltage having 1 V peak is applied to its input, and its output delivers a sinusoidal voltage of 14 V peak to a $1\text{ k}\Omega$ load. The amplifier draws a current of 14 mA from each of its two power supplies. The input current of the amplifier is measured to be sinusoidal with 0.2 mA peak. Find the voltage gain, the current gain, the power gain, the power dissipated in the amplifier, and the amplifier efficiency. (15%)
2. Draw the circuit models, the definition of gains, and the ideal values of input and output resistances for the four amplifier types based on the input-output signals (15%)
3. Derive the voltage gain for the circuit shown in Fig. 1. (10%)

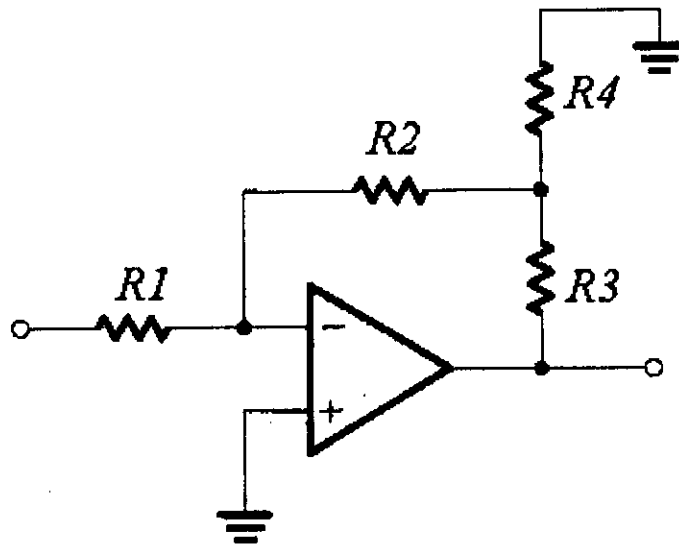


Fig. 1

4. Draw the equivalent-circuit models for simulating the diode and zener diode in SPICE, respectively. (10%)

(背面仍有題目,請繼續作答)

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5. (15 %) Explain the following terms generally used in electronics,

- (a) arithmetic logic unit (ALU)
- (b) application-specific integrated circuit (ASIC)
- (c) binary-coded-decimal (BCD) counter
- (d) data-rate buffer
- (e) flash analogue-to-digital converter (flash ADC)

6. (15 %) (a) Please compare the main features among Programmable Array Logic (PLA), complex programmable logic device (CPLD), and field-programmable gate array (FPGA).

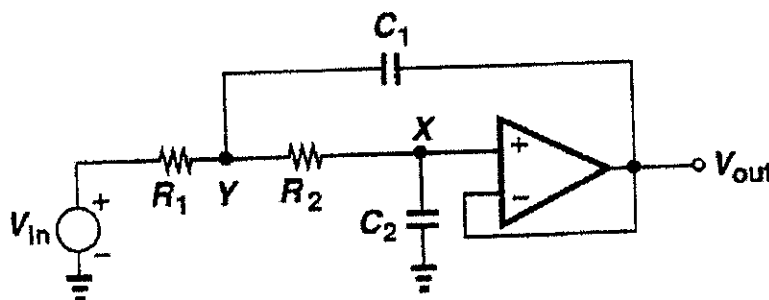
(b) Could you give an application example for each of these from your learning experience?

7. (20 %) Figure 2 is a second-order Sallen and Key filter with transfer function of $H(s)$:

$$H(s) = \frac{K}{s^2 + \frac{\omega_n}{Q}s + \omega_n^2} = \frac{V_{out}(s)}{V_{in}(s)}$$

(a) Assuming $V_X = V_{out}$ in an ideal op amp, please derive the $V_{out}(s)/V_{in}(s)$

(b) Please derive Q and ω_n under the conditions that $R_1 = R_2$ and $C_1 = C_2$.



(Fig. 2)