

2000년된 2학기 의용계측 중간사 해답

(1) $\Delta T = 100 \times \left(\pm \frac{0.05}{100} \right) = \pm 0.05^\circ C \Rightarrow 0.1^\circ C$

구분해야 할 온도 값의 수 $= \frac{100}{0.1} = 1000$

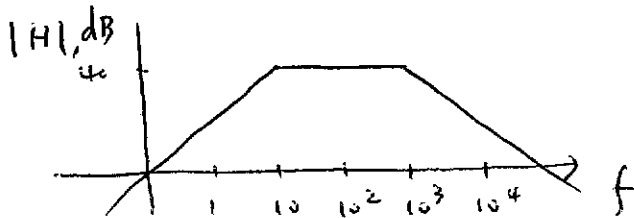
N bit ADC 의 경우, $2^N > 1000 \Rightarrow N = 10 \text{ bit}$

$2^N = 2^{10} = 1024$ 이므로, $\frac{5}{1024} = 4.88 \text{ mV}$

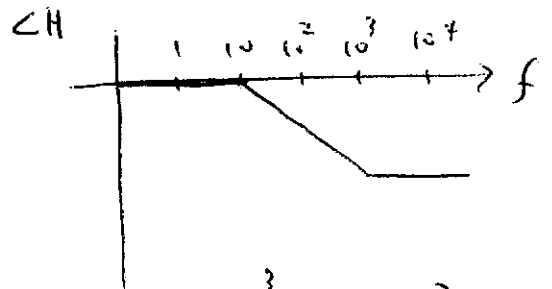
출력 표시 방법 :

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(2)



10 ~ 10³ Hz 범위 일정한 이득.



10 ~ 10³ Hz 범위 주파수에 대해 선형적인 기선

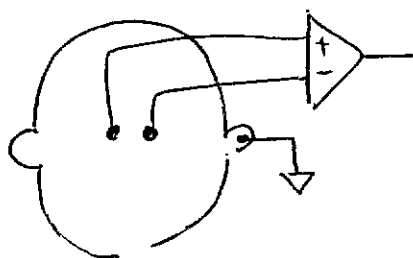
(3)

교재 p126, 그림 4.2

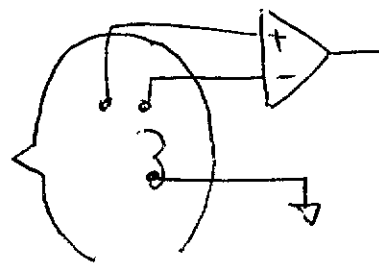
(4)

시각 자극

청각 자극

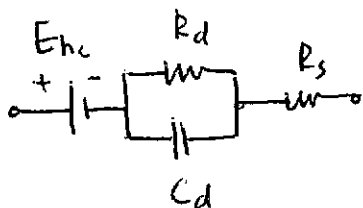


occipital lobe



temporal lobe

(5)



E_{nc} : 전하 이송층에 형성되는 dc 전위

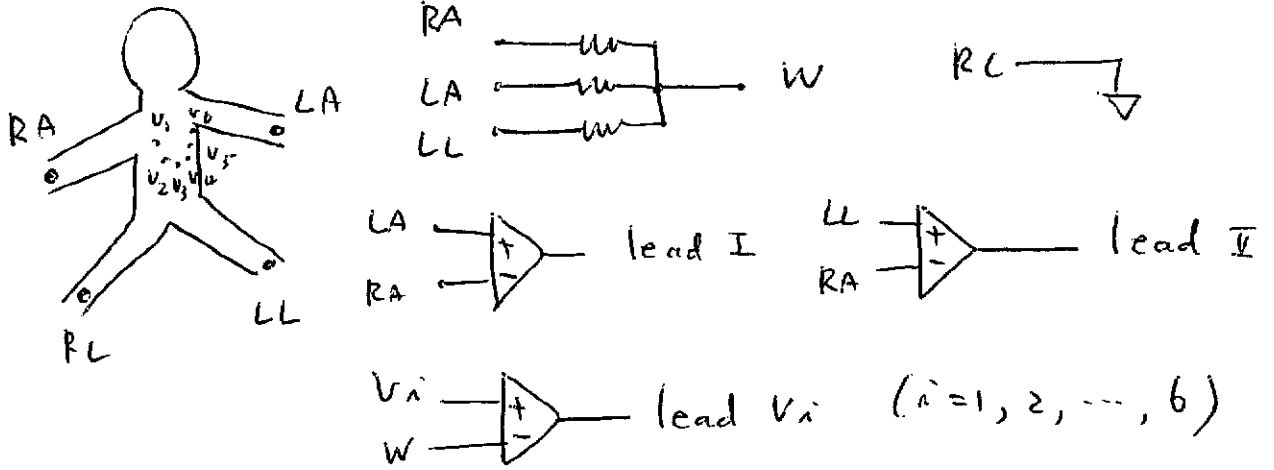
C_d : 전하 이송층의 용량

R_d : 전하 이송층의 누설 저항

R_s : 전해질의 저항

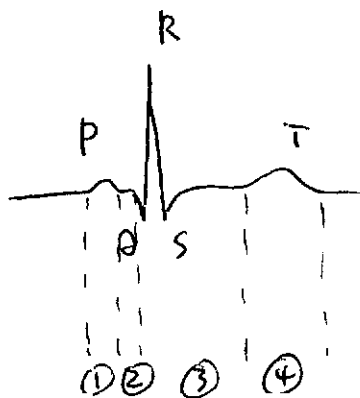
- 1 - 전극과 피부의 움직임 $\rightarrow E_{nc}$ 변화 : motion artifact

(6)



전극은 10개, 증폭기는 8 channel

(7)

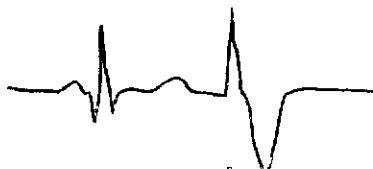


- ① 심방 수축
- ② AV node → His bundle 여기서 가면
- ③ 심실 수축
- ④ 심실 이완

(8)



ST elevation, ischemia



PVC, ectopic focus



Ventricular fibrillation, 여러개의 ectopic focus

(9)

$$V_{cm} = \hat{a}_b \cdot Z_4 = 80 \text{ mV}$$

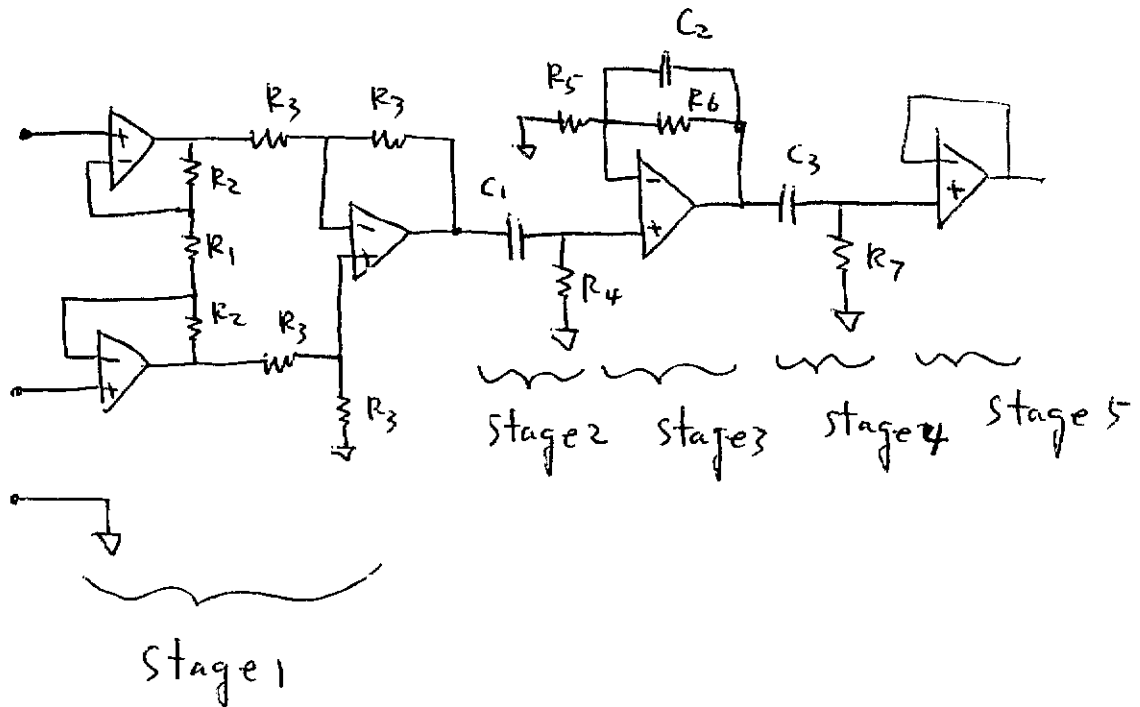
$$V_A = \frac{Z_{in}}{Z_1 + Z_{in}} V_{cm} = 75.43 \text{ mV}$$

$$V_B = \frac{Z_{in}}{Z_2 + Z_{in}} V_{cm} = 77.97 \text{ mV}$$

$$V_{dm} = V_A - V_B = 0.46 \text{ mV}, \quad V_{0, 60\text{Hz}} = V_{dm} \times 1000 = 0.46 \text{ V}$$

- ① Z_4, Z_1, Z_2 같게
- ② $Z_1 = Z_2$
- ③ $Z_{in} \gg Z_1$

(10)



- ① Stage 1 : $\frac{10}{0.3} = 33.3 \Rightarrow \frac{1}{5} = 30$
 $1 + 2 \frac{R_2}{R_1} = 30 \Rightarrow R_1 = 1 \text{ k}\Omega, R_2 = 14.5 \text{ k}\Omega, R_3 = 10 \text{ k}\Omega$
- ② Stage 2 : $\frac{1}{2\pi R_4 C_1} = 10 \Rightarrow C_1 = 0.1 \mu\text{F}, R_4 = 159.15 \text{ k}\Omega$
- ③ Stage 3 : $\frac{1}{T} \times \frac{1}{5} = \frac{10000}{30} = 333.3$
 $1 + \frac{R_6}{R_5} = 333.3, \frac{1}{2\pi C_2 R_6} = 1000$
 $\Rightarrow C_2 = 470 \text{ pF}, R_6 = 338.62 \text{ k}\Omega, R_5 = 1.02 \text{ k}\Omega$

$333.3 \times 1000 < 10 \times 10^6$ 이므로 GBP는 충분함.

Stage 3의 최대 dc offset 출력 = $10^4 \times 333.3 = 3.333 \text{ V}$

" " 신호 출력 = $500 \mu\text{V} \times 10^4 = 5 \text{ V}$

$5 + 3.333 < 10 \text{ V}$ 이므로 문제 해결 가능.

④ Stage 4 : Stage 3의 dc offset 제거, Stage 2의 동인기 설계.

⑤ Stage 5 : buffer, 최대 dc offset 출력 = $\pm 10 \text{ mV}$