* Differential Pairs [Intro.]

EXPT. NO. NAME

Page No.: Date: YOUVA

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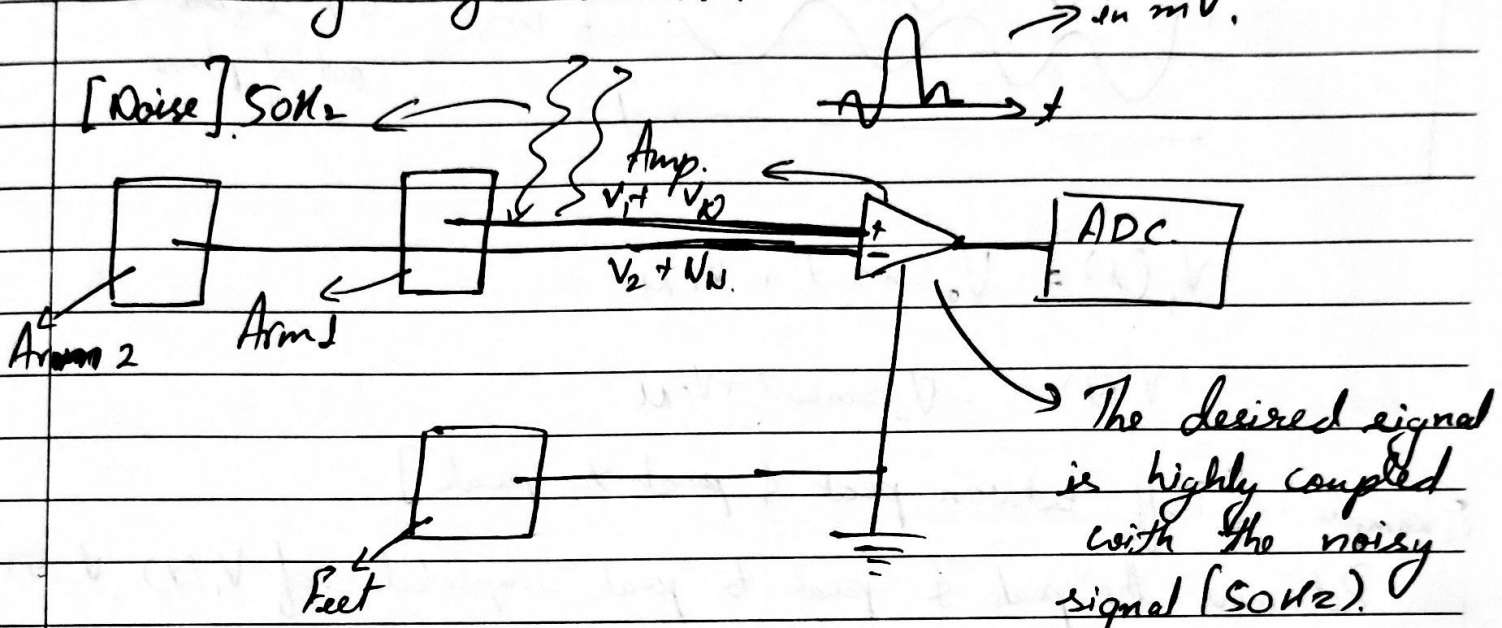
⇒ Problem of Noise Coupling.

Electrocardiogram System [ECG].

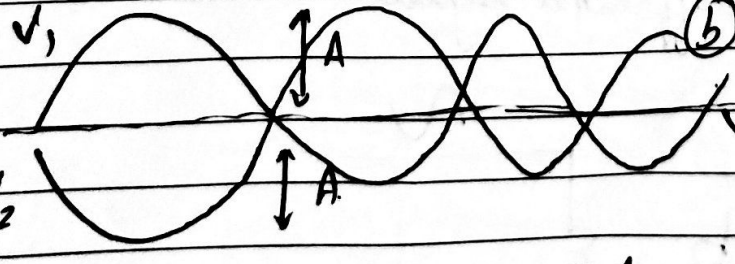


If we have 2 input ports then

$V_0 \simeq V_1 - V_2$ has no 50Hz noise.

→ These 2 lines make base study for differential signals.

* Differential Signals:- 2 properties → ⓐ Vary by equal & opposite amounts. [Equal & 180° out of phase]



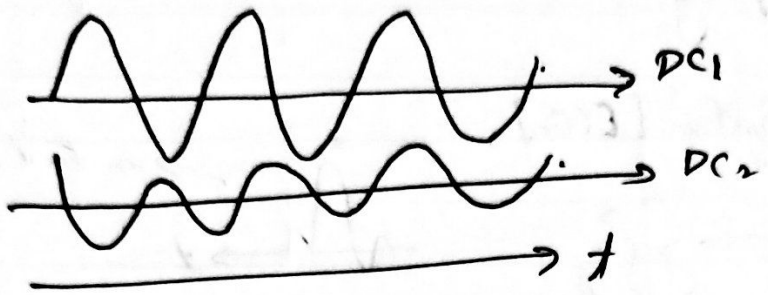
ⓑ They have the same average (DC) value.

V_{CM} → Common Mode Level.

↳ Here $DC_1 = DC_2 = V_{CM}$.

Teacher's Signature: _____

Not Differential ~~Pair~~ Signals



DC1 ≠ DC2

But equal & 180° out of phase.

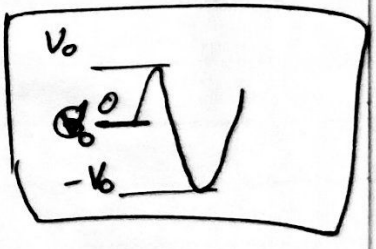
$$V_1(t) = V_0 \sin\omega t + V_{CM}$$

$$V_2(t) = -V_0 \sin\omega t + V_{CM}$$

Example :- [Diff. between peak & peak to peak]

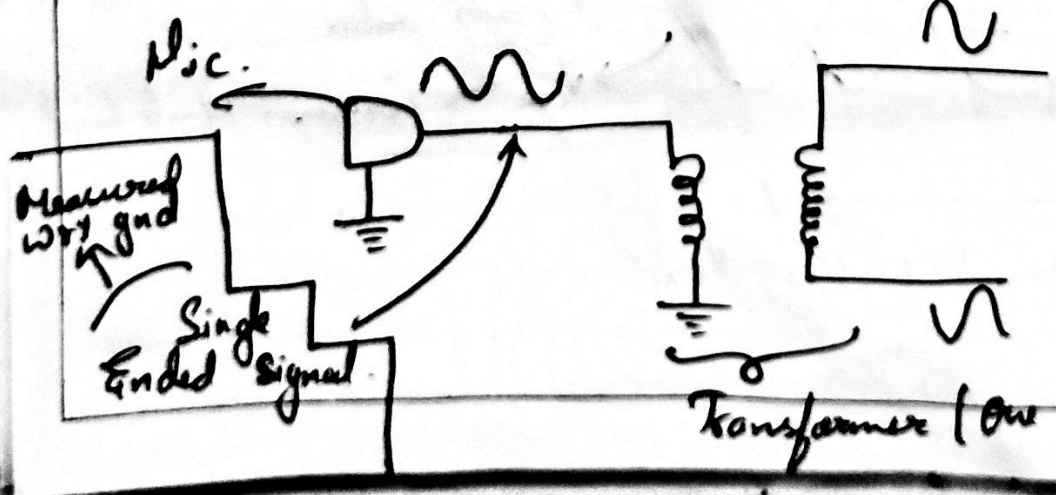
Determine the peak & peak to peak amplitudes of $V_1(t)$, $V_2(t)$ & $V_1 - V_2$.

$$V_1 - V_2 = 2V_0 \sin\omega t$$



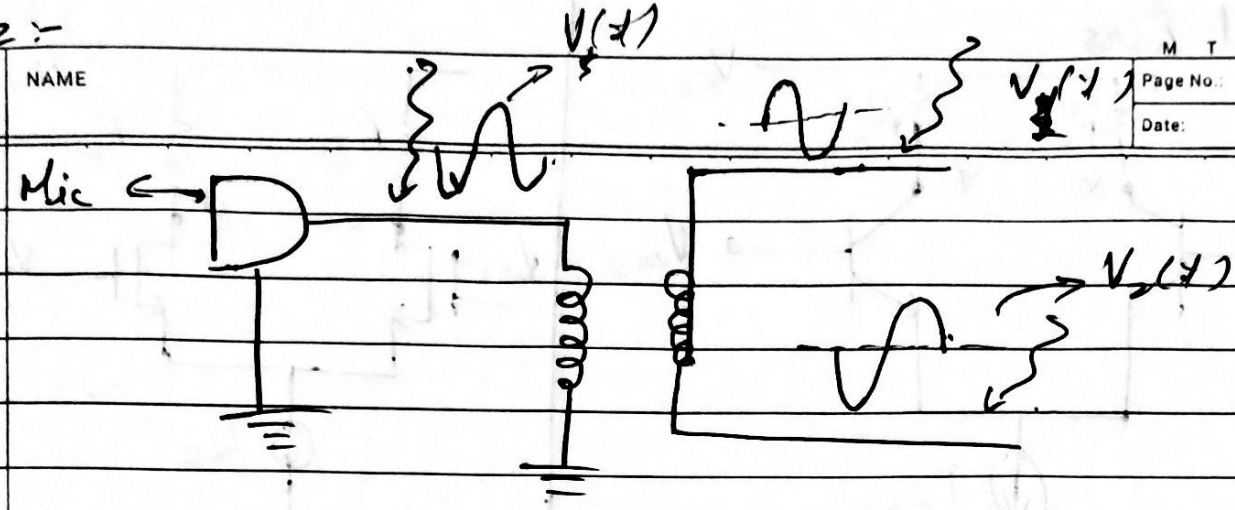
	V_1	V_2	$V_1 - V_2$
Peak amplitude	V_0	V_0	$2V_0$
Peak to peak amplitude	$2V_0$	$2V_0$	$4V_0$.

② How do we generate differential signals?



Quiz :-

EXPT. NO. | NAME | M T W T F S S | Page No. | Date: | YOUVA



Case :- 1 [Noise Coupling on Single-Ended Signal]

Case :- 2 [Noise Coupling on both the differential signals]

(1) $V(t) = 2V_0 \sin\omega t + V_N$

(2) $V_1(t) = V_0 \sin\omega t + \frac{V_N}{2}$

$V_2(t) = -V_0 \sin\omega t + \frac{V_N}{2}$

$V_d(t) = V_1(t) - V_2(t)$

$= 2V_0 \sin\omega t$

Output without Noise

Differential Pairs.