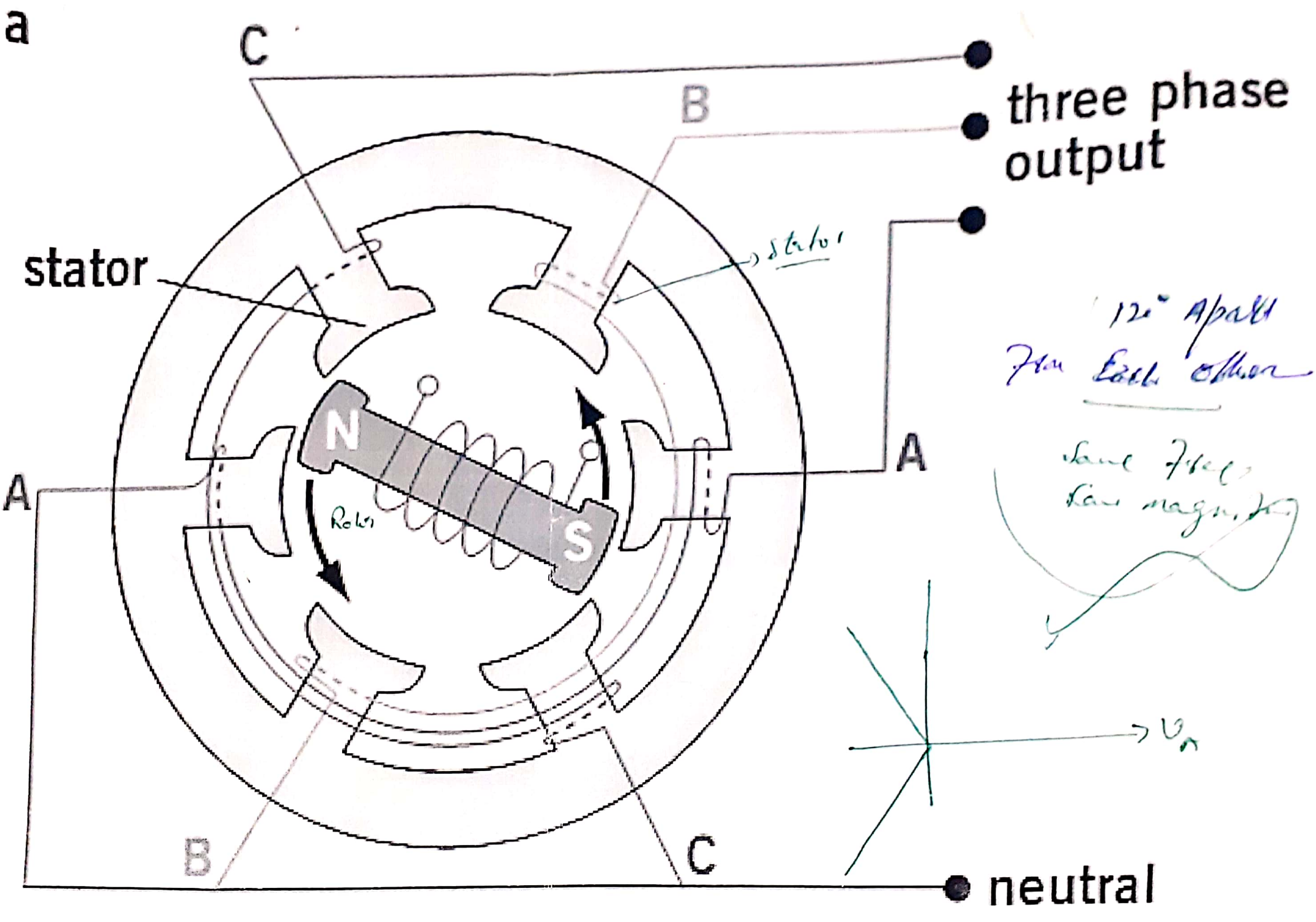
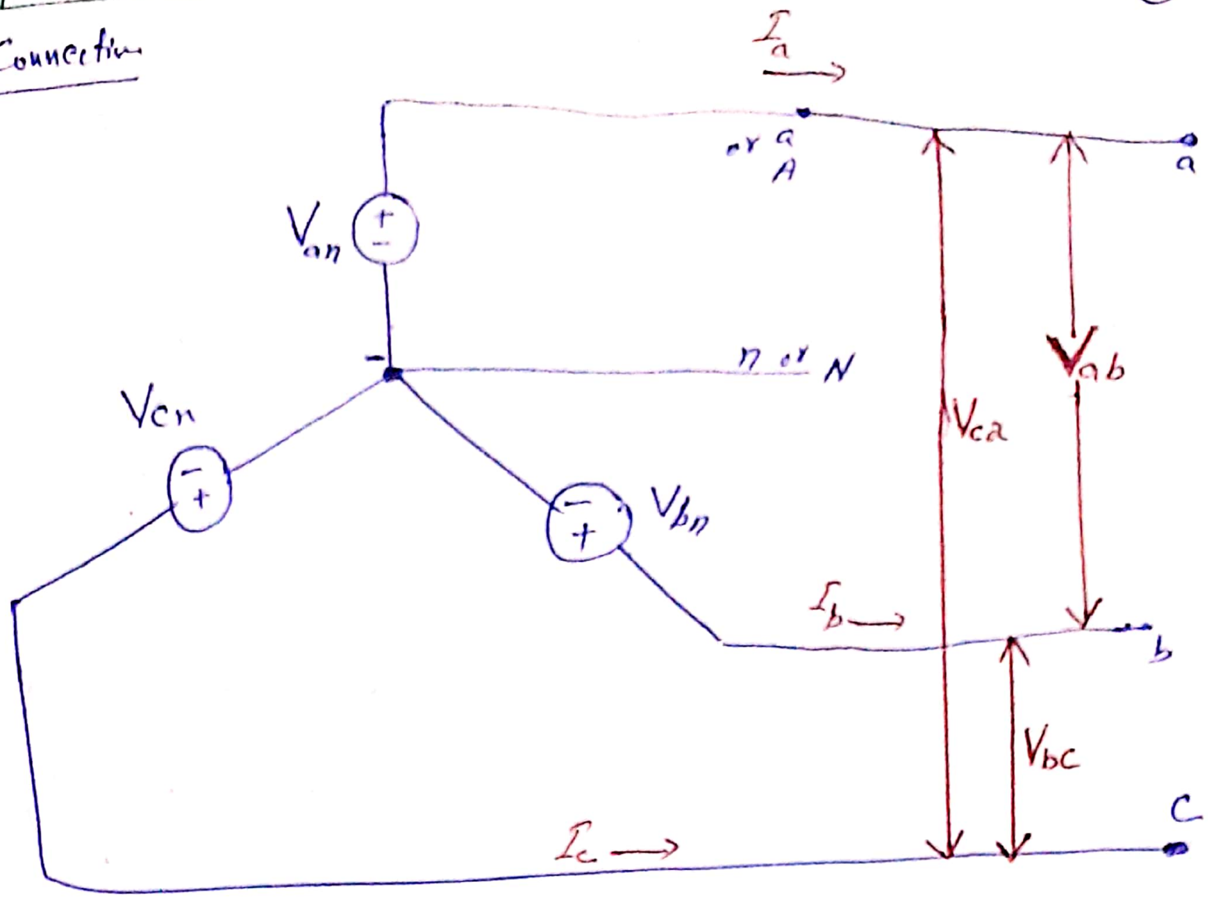

a
C
B
three phase
output
stator
stator
120° Apart
from Each other
Same Freq
Same magnitude
N
S
Rotor
A
A
V_n
B
C
neutral

3-φ Source

Y- Connection



(1) Terminal Line or fire Line

" The terminal a, b, c are called the terminal lines."

(2) Neutral line & neutral Point (N)

(3) Three Phase four- Line system. (ABCN is four Lines)

(4) **Line Current** (I_a, I_b & I_c) is called the line curr

" The current flow through every terminal is called the line current " shown in figure (I_L)

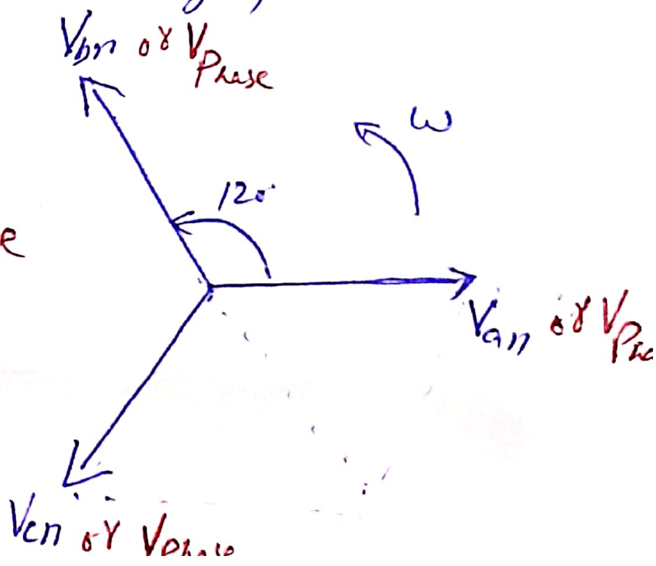
(5) **Line Voltage** (Line to Line Voltage)

V_{ab}, V_{bc}, V_{ca} → Line voltage)

" The voltage between the terminal Lines is called the Line voltage.

denoted with V_{ab}, V_{bc} & V_{ca}

$$V_L = V_{ab} = V_{bc} = V_{ca}$$



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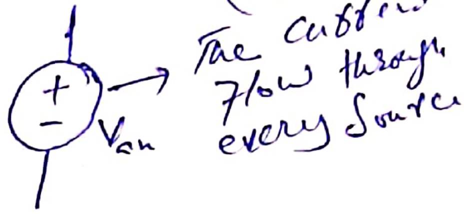
The Voltage & current in every Phase is ②

(6) **Phase Current (I_P)**

" The Phase current is the current flow through every ~~Phase~~ "Source" (I_P)

I_P



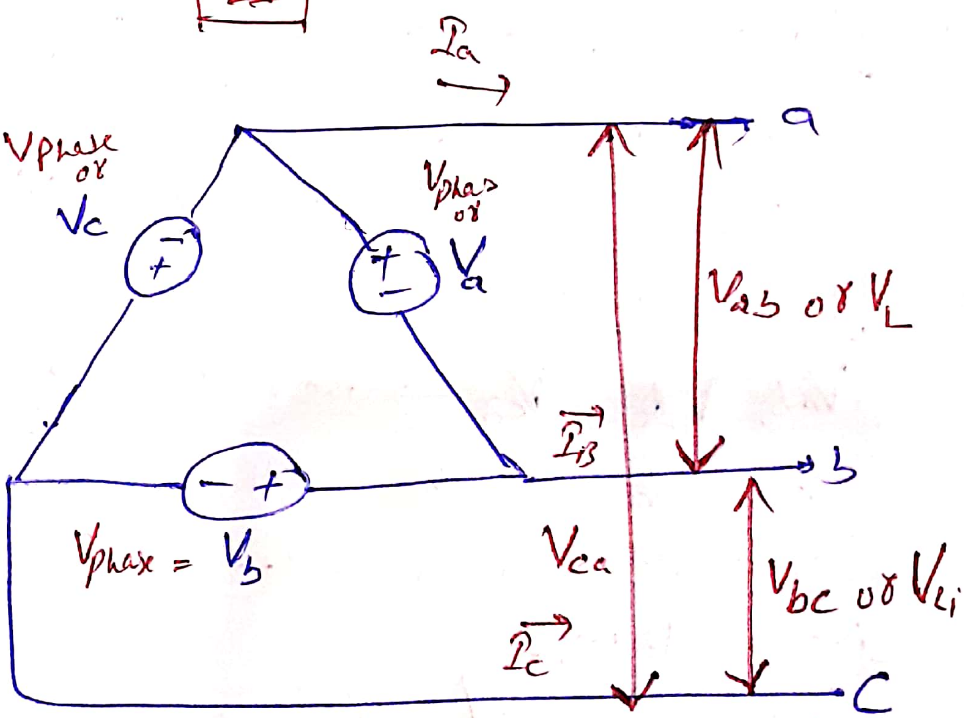
7) **Phase Voltage (V_P)** (V_{an}, V_{bn}, V_{cn})

Every Phase has it's Phase Voltage.

Remember
⇒ Source Provides Power to the External

Load → absorb Power

$\boxed{\Delta}$



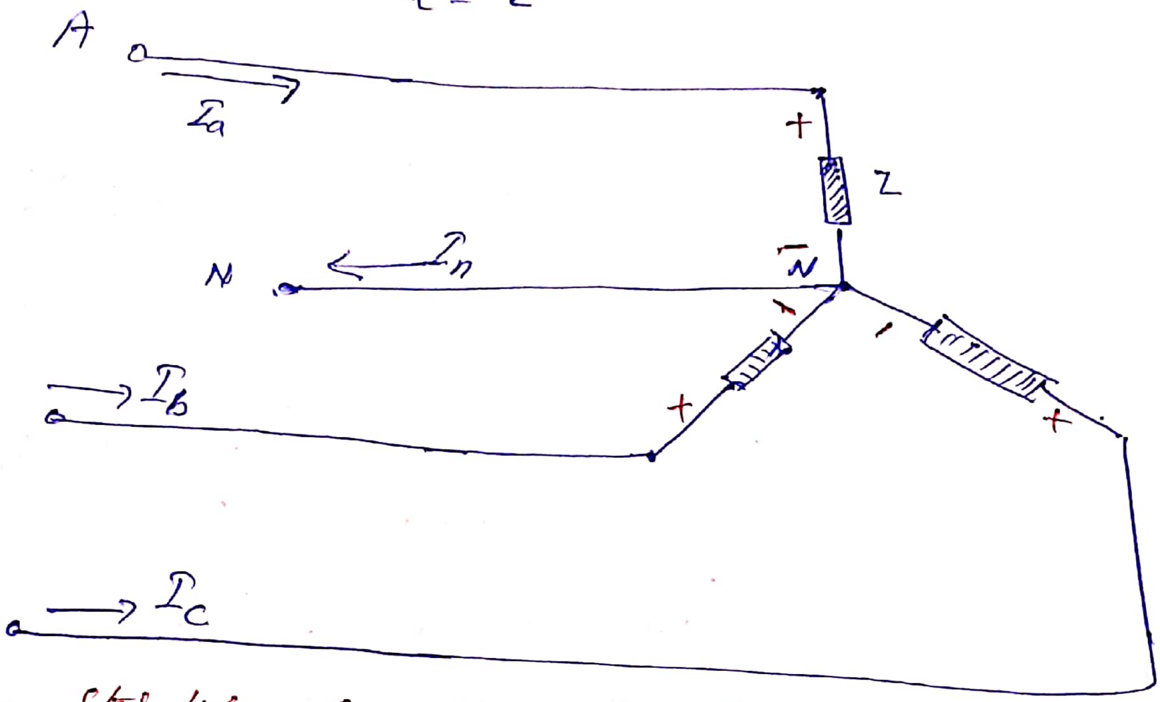
Balance wye - wye Connection OR

Star ~~or~~ Y- Connection & its Phase - Line Relationship

$\boxed{Y-Y}$

Balance 3 ϕ Source & Balance 3 ϕ Load.

$Z_L = Z$



In the star/wye connection, its obvious that the phase current = line current

$$\boxed{\text{Phase current} = \text{Line Current} \quad I_p = I_L}$$

But we interested in the phase → line relationship of the load voltage

We know that in 3 ϕ System, Every load (V_L) is connected to the corresponding Phase Source Voltage (V_p)

The Phase Voltage of the Load is Balance.

$$V_{an} = V_p \angle 0^\circ \longrightarrow (1)$$

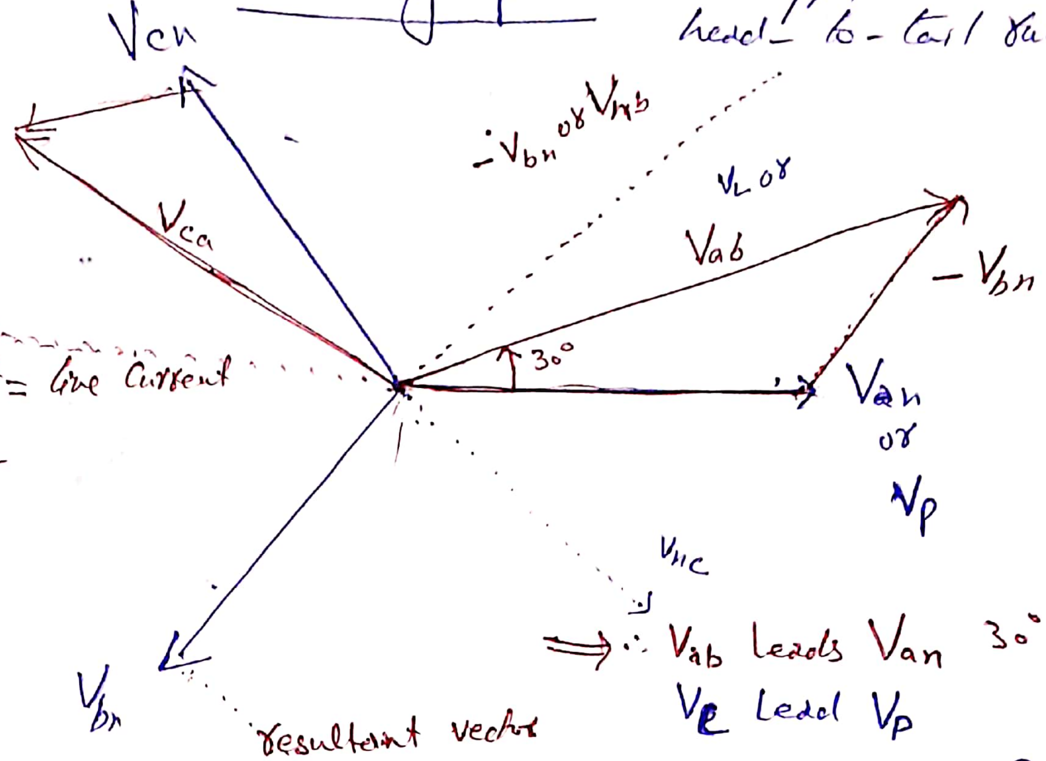
$$V_{bn} = V_p \angle -120^\circ \longrightarrow (2)$$

$$V_{cn} = V_p \angle +120 \longrightarrow (3)$$

(4

Phasor graph

We apply the head-to-tail rule



Phase Current = Line Current

$I_p = I_L$

$\Rightarrow \therefore V_{ab}$ leads V_{an} 30° degree

V_L Lead V_p

Mathematically

$$\therefore V_{ab} = V_{an} - V_{bn} \longrightarrow (4)$$

Putting the value from Eq (1) & (2) in Eq (4) we get

$$V_{ab} = V_p \angle 0^\circ + (-V_p \angle -120^\circ)$$

$$V_L = V_p \angle 0^\circ - V_p \angle 120^\circ$$

Converting from Rectangular to Polar

$$V_L = V_p[\cos(0^\circ) + j\sin(0^\circ)] - V_p[\cos(-120^\circ) + j\sin(120^\circ)]$$

$$V_L = V_p[1] - V_p[(-0.5) + j(-0.866)]$$

$$V_L = V_p + V_p(0.5) + j\,0.866$$

$$V_L = V_p[1 + 0.5 + j\,0.866]$$

$$V_L = V_p[1.5 + j\,0.866]$$

Converting back in Polar

$$V_L = V_p\{1.73 \angle 30^\circ\} \Rightarrow V_L = \sqrt{3}\,V_p \Rightarrow \boxed{V_p = \frac{1}{\sqrt{3}} V_L}$$