Adda247

WELCOME TO Adda247

Hard work matters!

ARE YOU READY ?
EE & EC GUYS
GATE 2024
Adda247 GATE
GURUKUL BATCH

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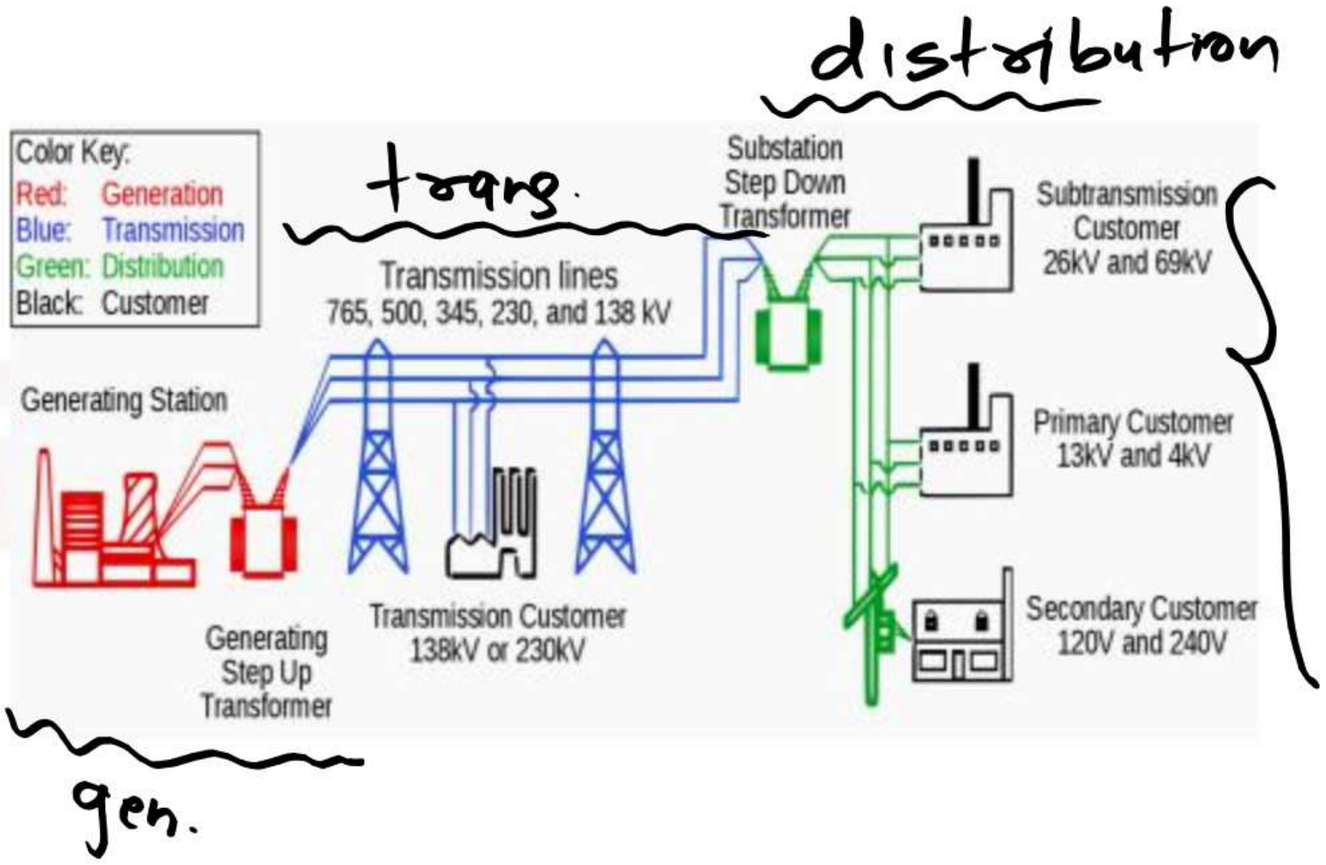
POWER SYSTEM ANALYSIS

- Power system analysis is a branch of electrical engineering that deals with the analysis and design of power systems, which are networks of interconnected power components that generate, transmit, and distribute electrical power to consumers. The purpose of power system analysis is to ensure the safe, reliable, and efficient operation of power systems.



RECENT TRENDS OF PSA IN GATE::

YEAR	PERCENTAGE OF MARKS
2023	9
2022	8
2021	12
2020	11
2019	11

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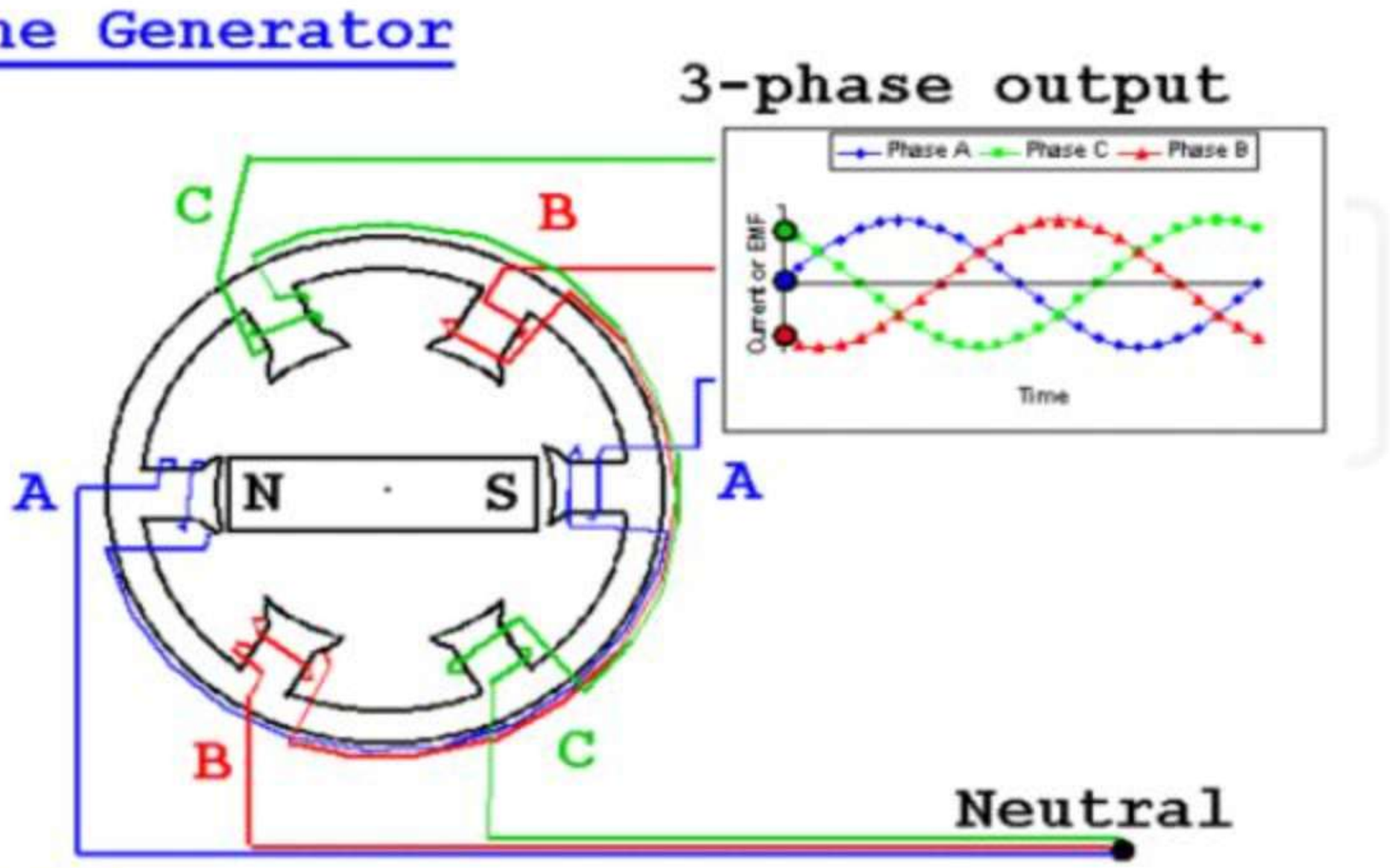
TODAY'S TOPIC: BASICS OF 3 PHASE



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WHY ONLY 3 PHASE CIRCUITS ARE USED FOR GENERATION AND TRANSMISSION?

$P = V_p I_p \cos\phi$

$P_{3\phi} = 3 V_p I_p \cos\phi$

$V_p \uparrow \rightarrow$ insulation $\uparrow \rightarrow$ cost $\uparrow$

$I_p \uparrow$ cross sectional area $\uparrow \rightarrow$ cost $\uparrow$

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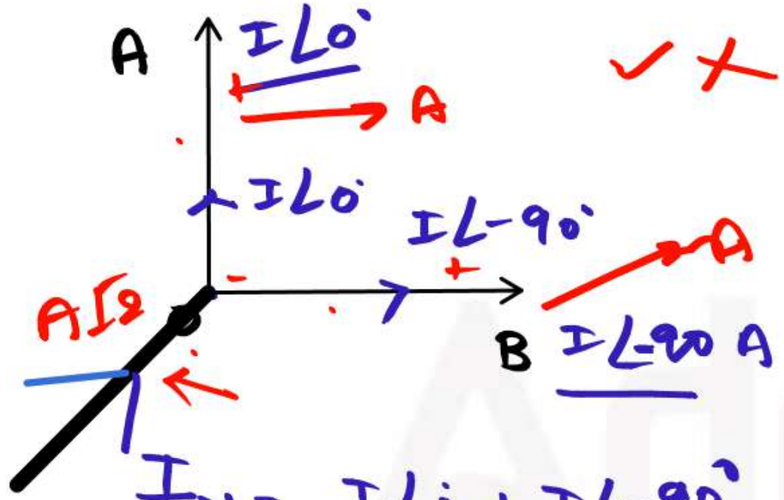
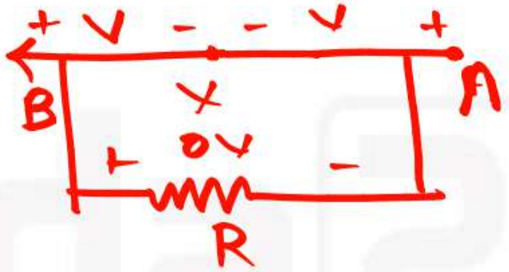
2 PHASE SYSTEM

Imp.



$I_N = I\angle 0° + I\angle -90°$

$I_N = I\sqrt{2}\angle -45°$



GATE

Eg

balanced system

Peak/rms value of vlg or current of all the phases must be same.

angle b/w two phase $\rightarrow \theta_n = \frac{360°}{n}$ $n > 2$

$= 90°$ $n = 2$ ←

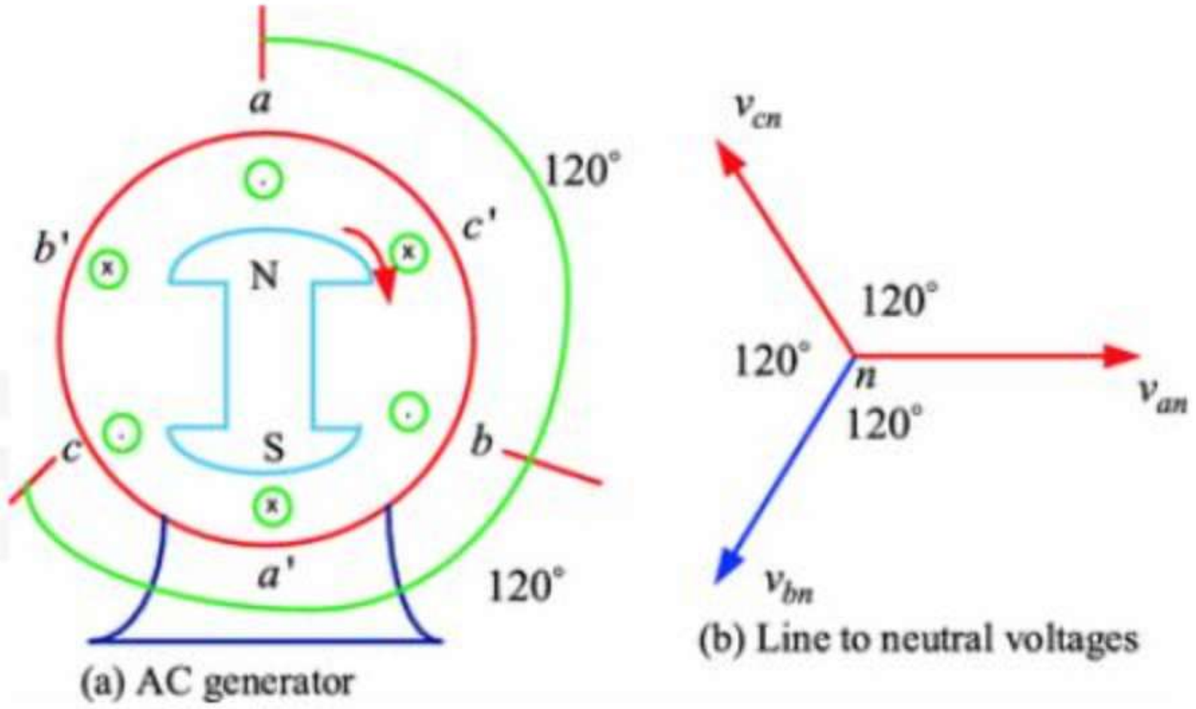
$V_A = V_m \cos \omega t$

$V_B = V_m \sin(\omega t + \theta_1)$

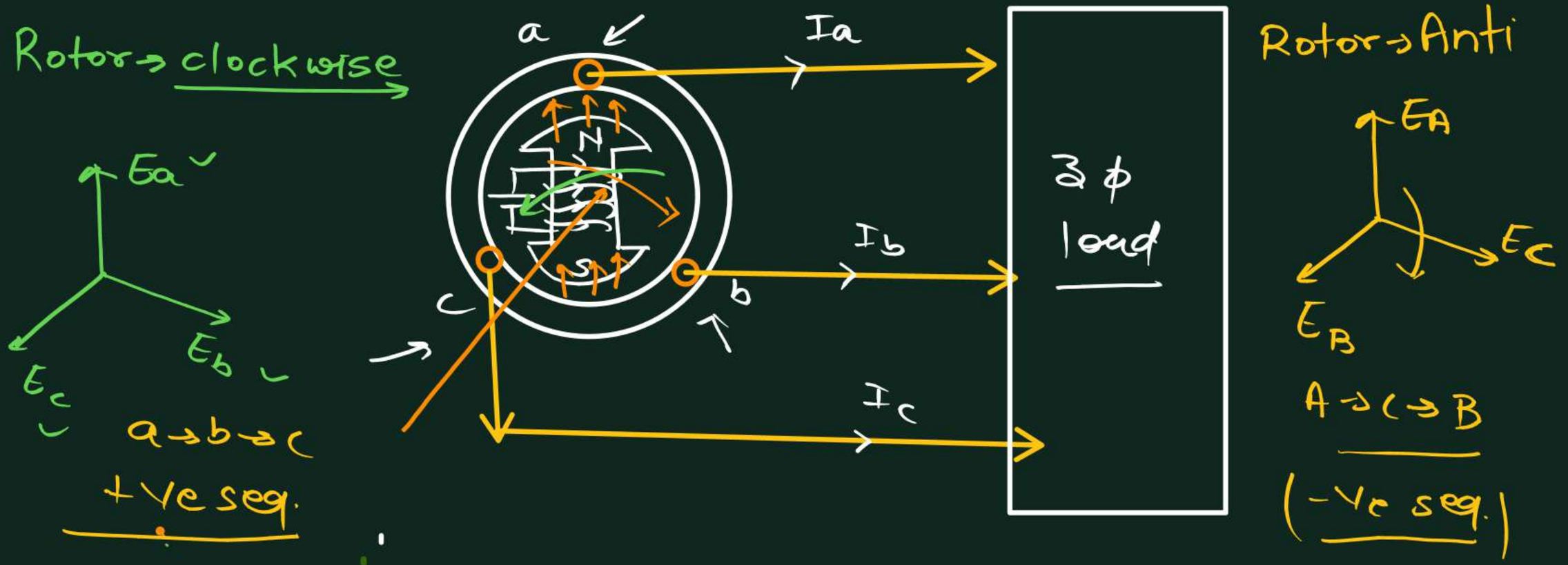
2 phase system

$\theta_1 = ?$

GENERATION OF 3 PHASE:



Generation of 3 phase :→



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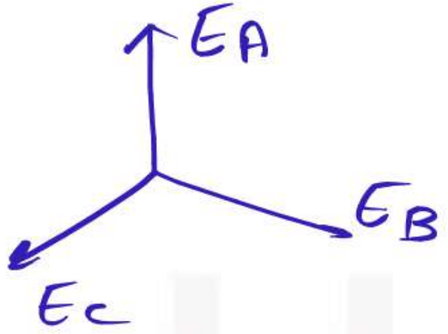
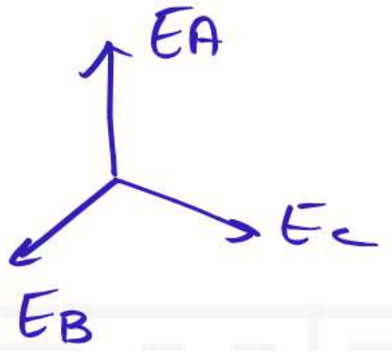
SEQUENCE OF 3 PHASE:



+ve seq



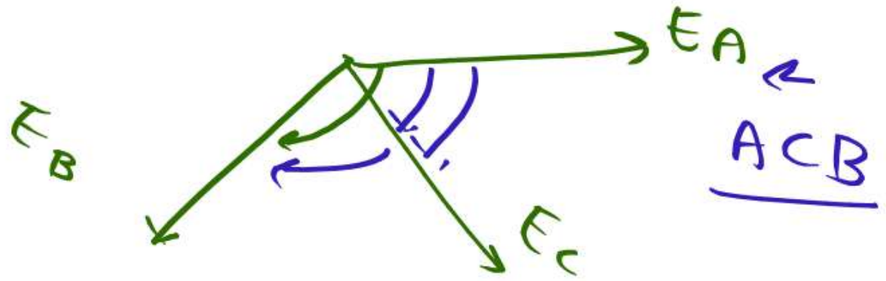
-ve seq.

seq → the order in which max^m emf appears.

DRDO

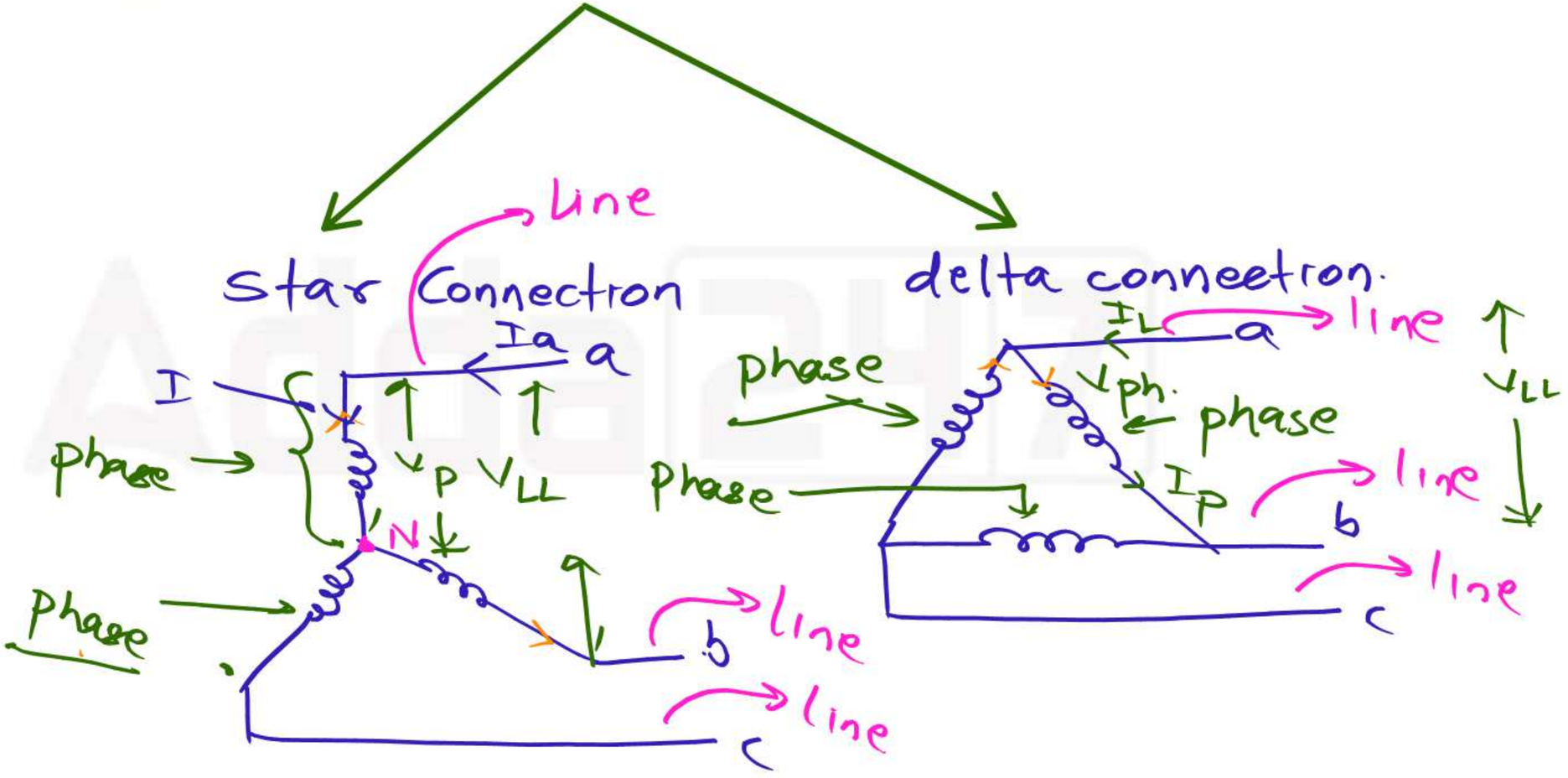
eg. $E_A = E\angle 0^\circ$ $E_B = E\angle -120^\circ$

$E_C = E\angle -73^\circ$



ACB

TYPES OF 3 PHASE CONNECTIONS:



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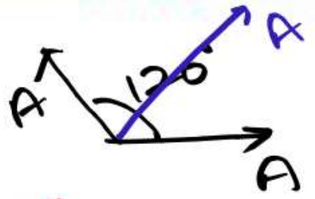
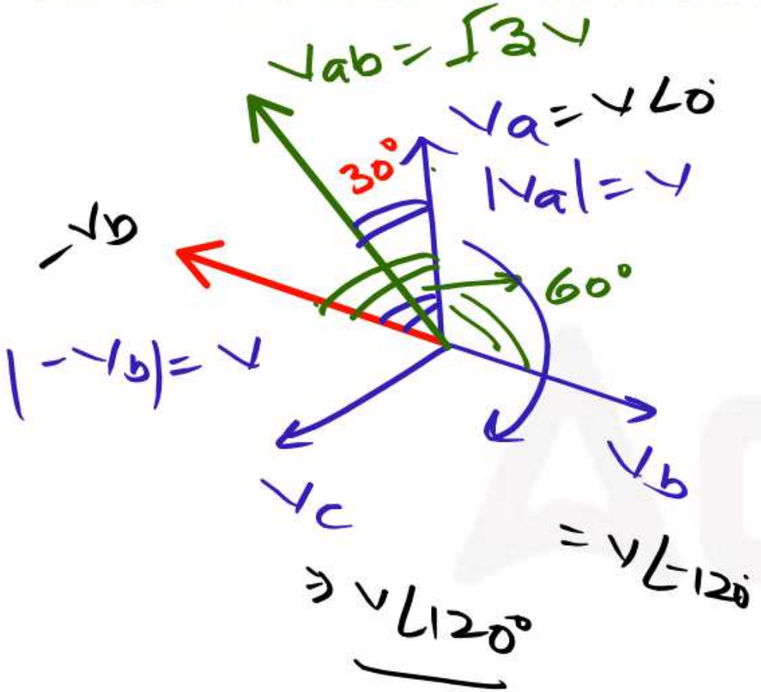
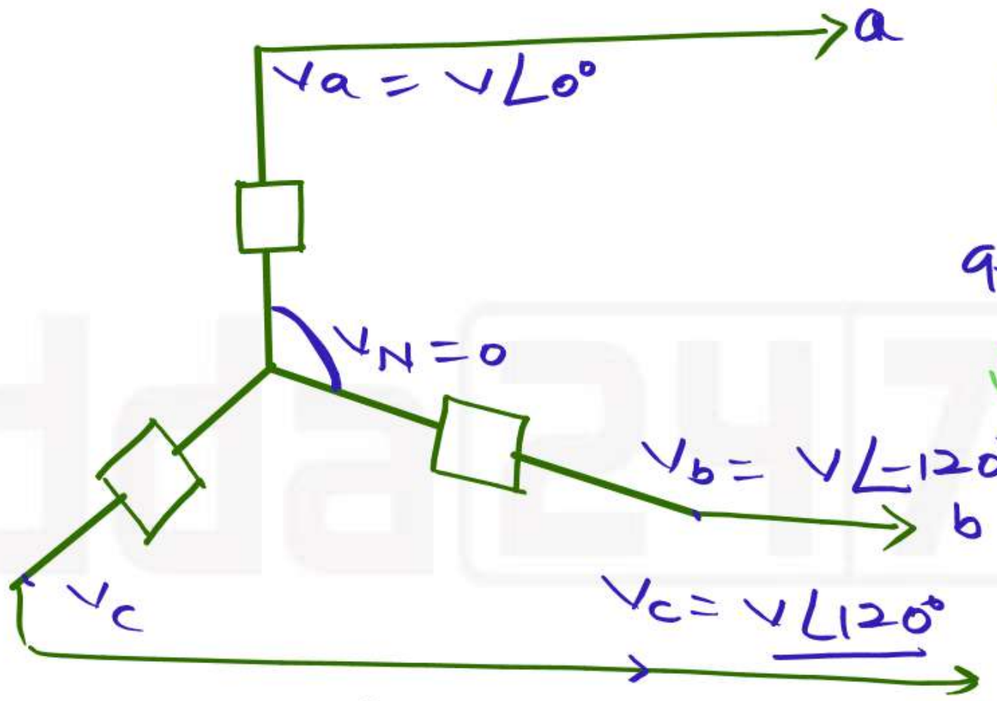
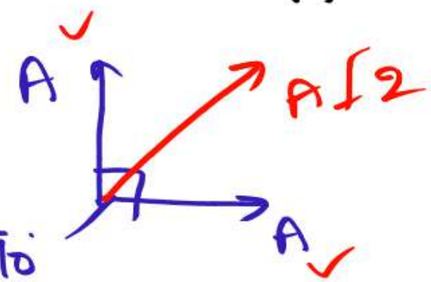
BALANCED SYSTEM:

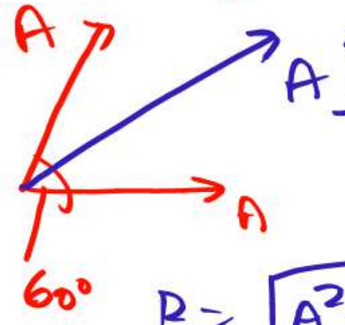
+ve seq (λ connection)











$R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

$V_{ab} = ?$

$V_{ab} = V_a - V_b = V_a + (-V_b)$

$V_{ab} = \sqrt{3}V\angle 30°$

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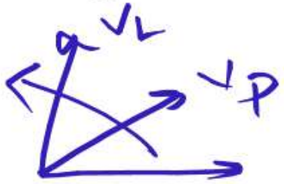
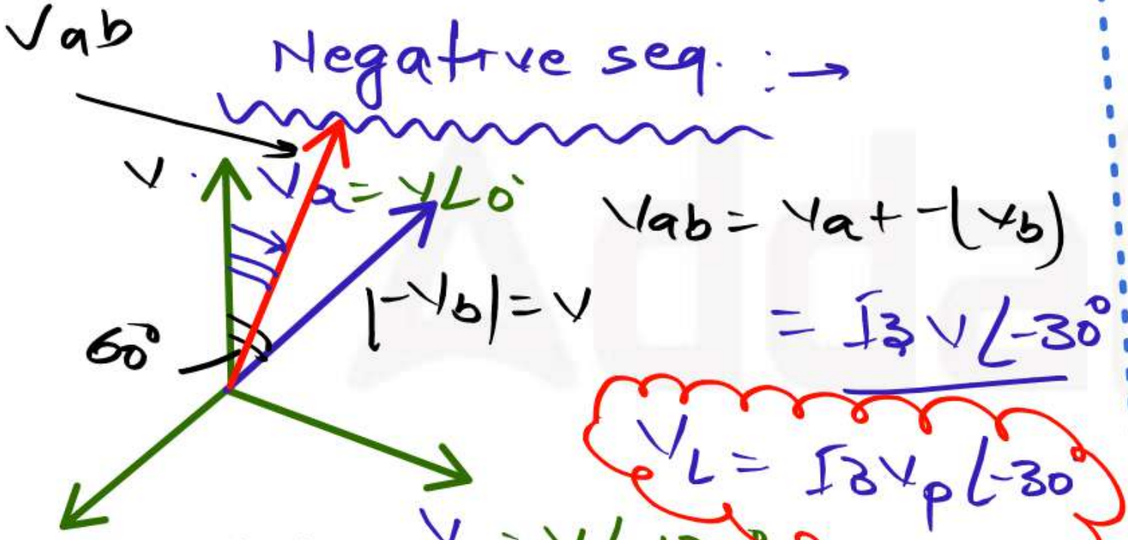
RELATIONS BETWEEN LINE AND PHASE VALUE:

$V_{ab} = \sqrt{3}\, V \angle 30^\circ \Rightarrow \boxed{V_{Line} = \sqrt{3}\, V_p \angle 30^\circ}$ → (+ve seq.)





$V_{ab} = V_a + -(V_b)$

$= \sqrt{3}\, V \angle -30^\circ$

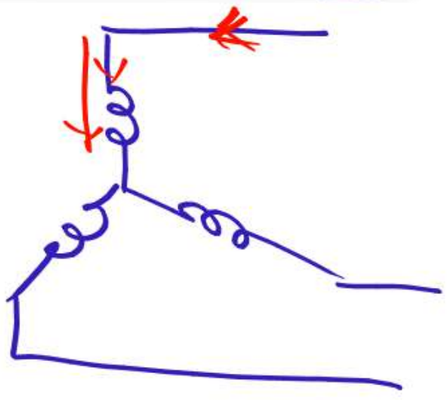
$V_L = \sqrt{3} V_p \angle -30^\circ$

-ve seq.

$V_p = 10 \angle 30^\circ$

$V_{Line} = \sqrt{3} \times 10 \angle 30^\circ \angle 30^\circ$

$= 10\sqrt{3} \angle 60^\circ$



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RELATIONS BETWEEN LINE AND PHASE VALUE:

+ve seq. $V_L = \sqrt{3} V_p \angle 30^\circ \quad I_L = I_p$

-ve seq. $V_L = \sqrt{3} V_p \angle -30^\circ \quad I_L = I_p$.

→ Actual

in pu $\begin{cases} V_L = V_p \angle 30 \ (+ve \text{ seq.}) \\ V_L = V_p \angle -30 \ (-ve \text{ seq}) \end{cases}$ (Y)

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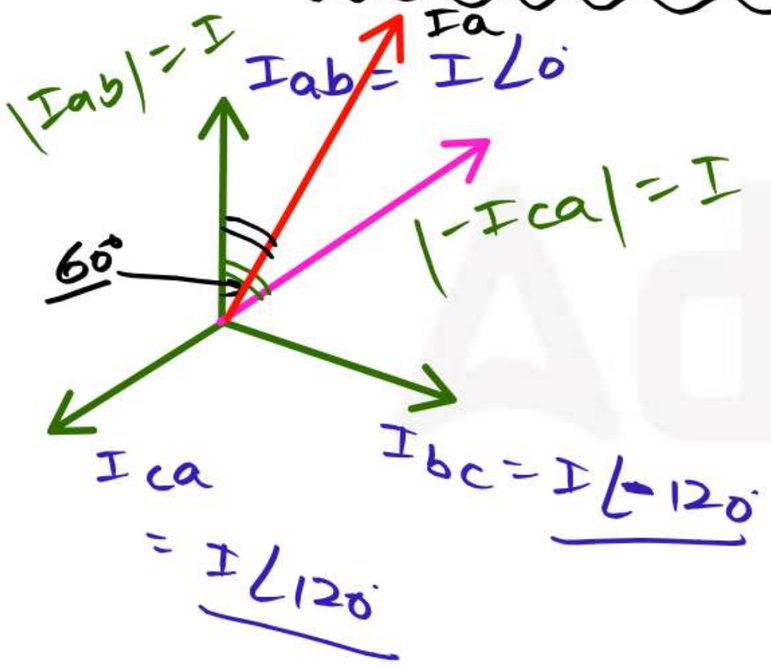
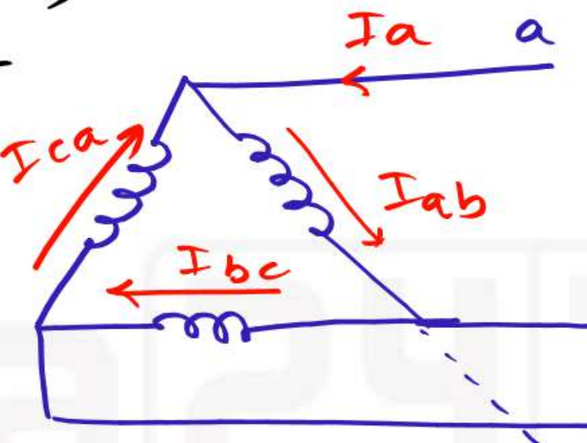
RELATIONS BETWEEN LINE AND PHASE VALUE:

delta-connection :→





$I_a + I_{ca} = I_{ab}$

$\Rightarrow I_a = I_{ab} - I_{ca}$

$= I_{ab} + (-I_{ca})$

$I_{ab} \rightarrow I_{bc} \rightarrow I_{ca}$

+ve

$I_a = \sqrt{3} I \angle -30°$

I_{bc}

$I_L = \sqrt{3} I_p \angle -30°$

+ve seq.

SOME TRICKS:

$I_L = \sqrt{3} I_p \angle -30$

$=$ ⇓

Δ-conn. (+ve seq)

$V_L = \sqrt{3} V_p \angle +30$

⇓

Y conn (+ve)

+ve seq. | (-ve seq.)

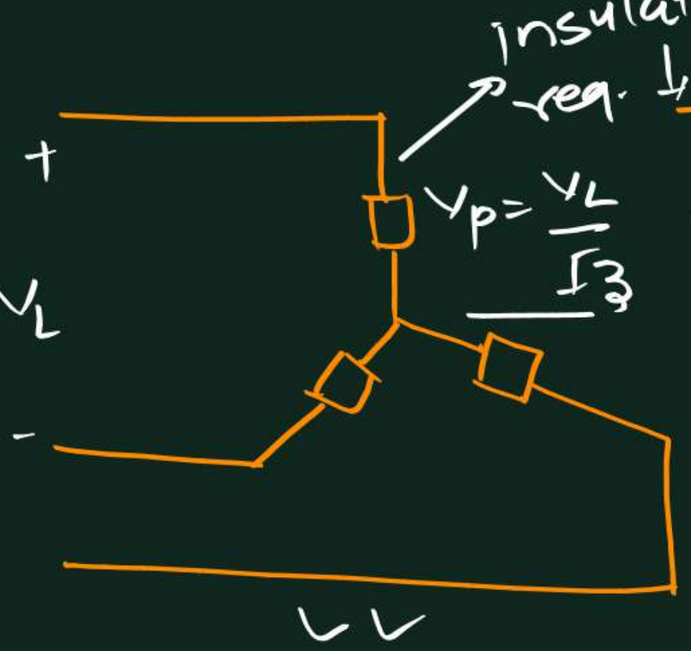
	+ve seq.	-ve seq.
Y	$V_L = \sqrt{3} V_p \angle 30$ $I_L = I_p$	$V_L = \sqrt{3} V_p \angle -30$ $I_L = I_p$
Δ	$I_L = \sqrt{3} I_p \angle -30$ $V_L = V_p$	$I_L = \sqrt{3} I_p \angle +30$ $V_L = V_p$

Selection of 3 ϕ connections

Volt → Insulation

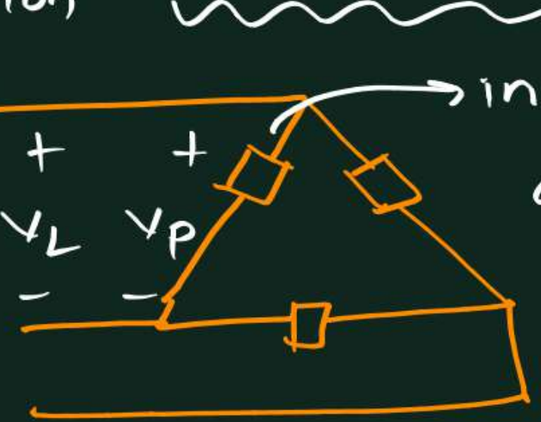
H.V circuit

L.C



insulation req. ↓

$V_p = \frac{V_L}{\sqrt{3}}$



insulation ↑

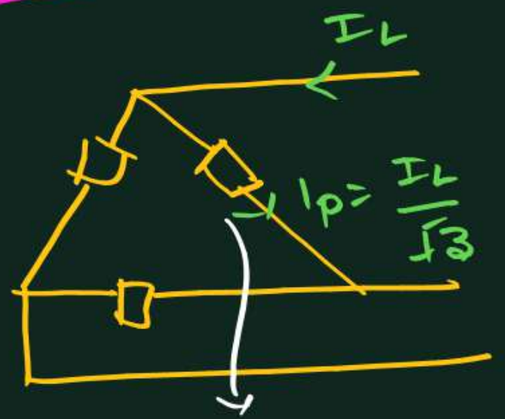
cost ↑

$V_p = V_L$

High current

Low V/g

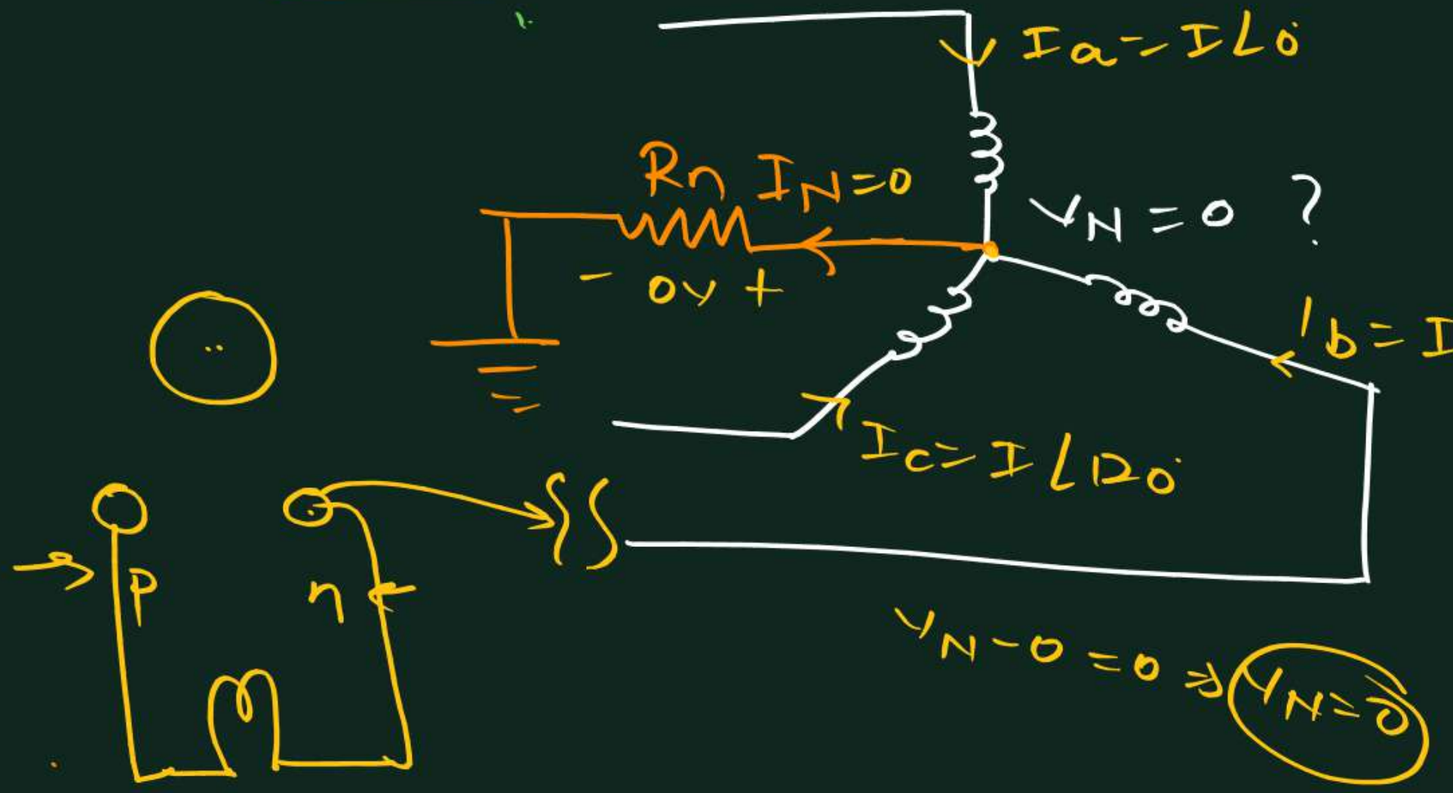
Cross sectional ↑



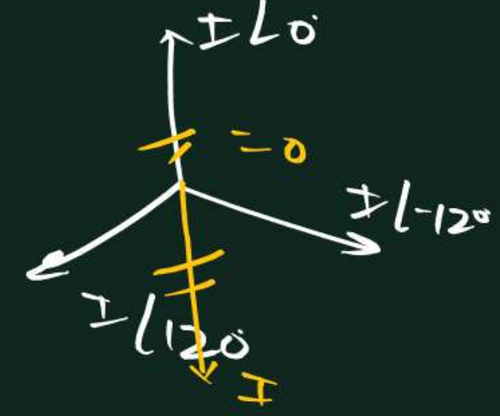
Cross-sectional area ↓

Cost ↓

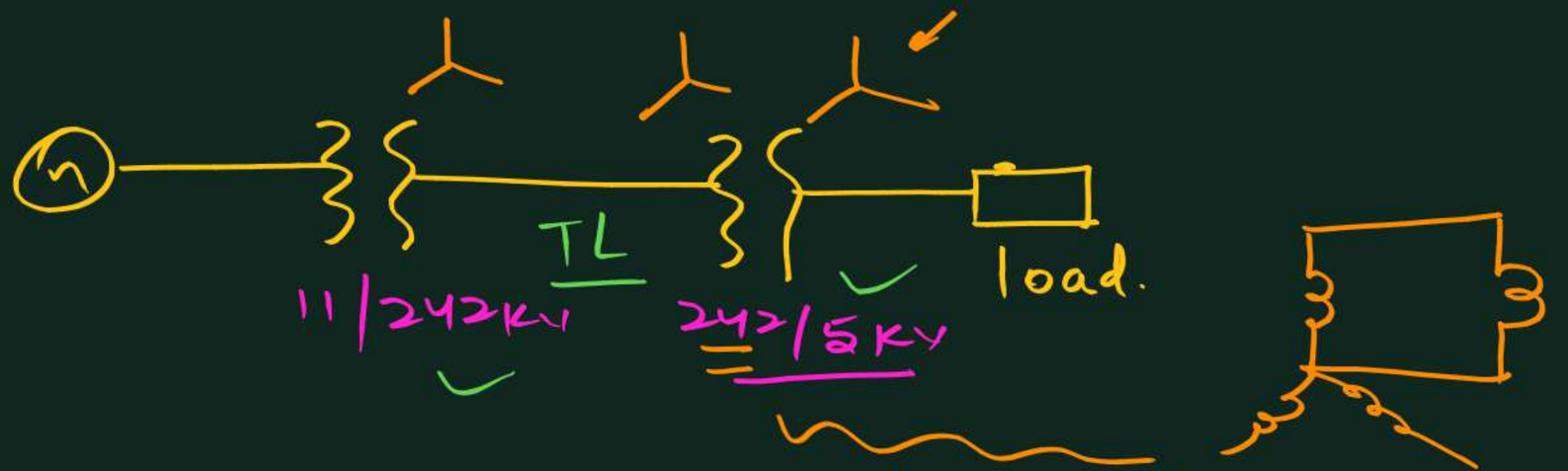
$V_N = 0$?



$I_N = I\angle 0 + I\angle -120 + I\angle 120 = 0$



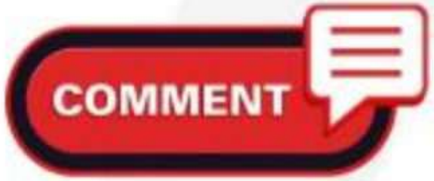
eg :->



↳* TLs are supposed to be Δ connected.

New Product available on Adda247 App

THANKS FOR

Watching

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