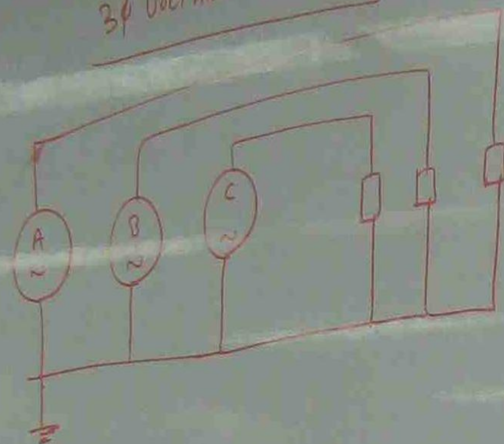
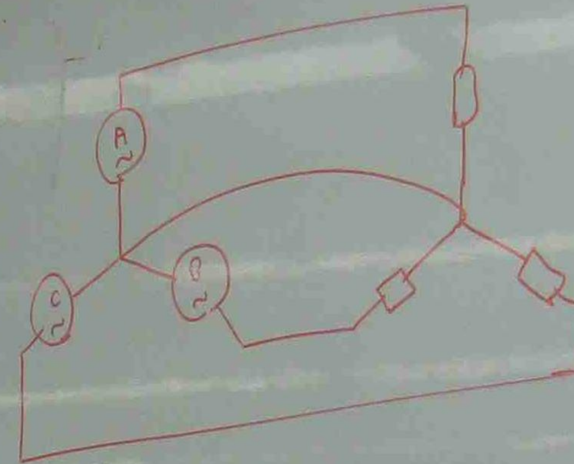
EXERCISE

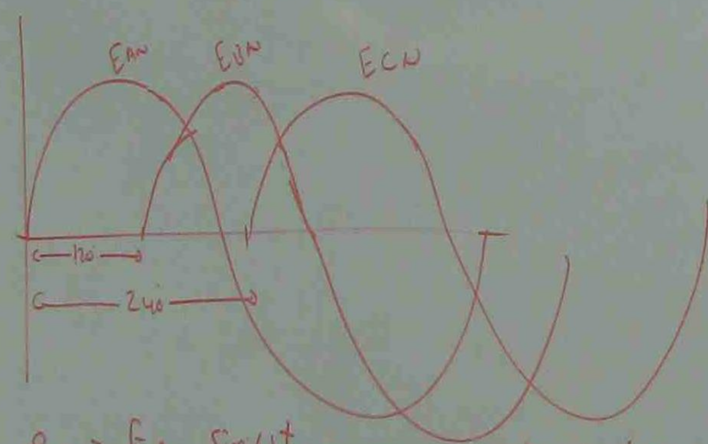
CONSTRUCT A PHASOR DIAGRAM OF TWO VECTORS $V_{CN} = 200\angle 120^\circ$ V AND $V_{BN} = 200\angle -120^\circ$ V WHERE N IS COMMON TO BOTH ORIGINAL VOLTAGES.

FIND THE MAGNITUDE AND ANGLE OF VOLTAGE V_{BC}

3φ VOLTAGE GENERATION







$$e_A = E_{AN}\sin\omega t \longrightarrow E\angle 0$$

$$e_B = E_{BN}\sin(\omega t - 120) \longrightarrow E\angle -120$$

$$e_C = E_{CN}\sin(\omega t - 240^\circ) \longrightarrow E\angle -240$$

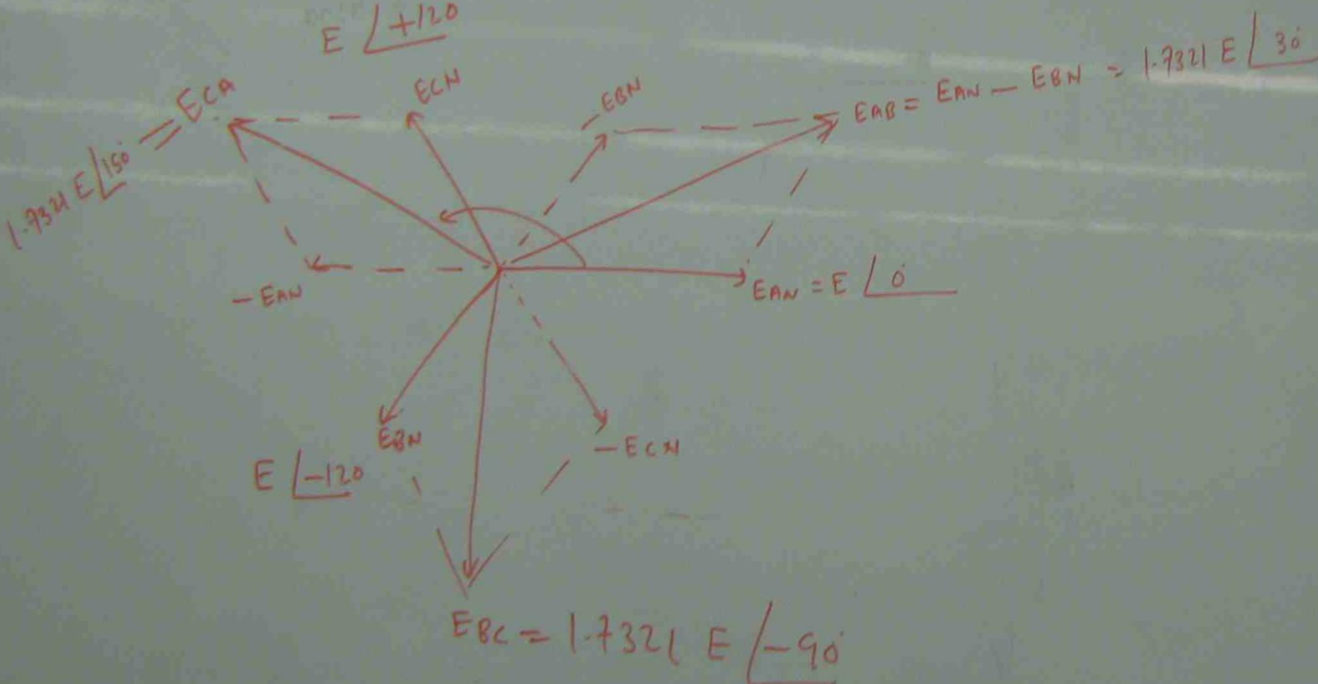
$$E_{AN} + E_{BN} + E_{CN} = E\angle 0 + E\angle -120 + E\angle 120$$

$$= E(\cos 0 + j\sin 0) + E(\cos 120 - j\sin 120) + E(\cos 120 + j\sin 120)$$

$$= E(1 + j0) + E(-0.5 + j0.866) + E(0.5 - j0.866)$$

$$= 0$$

3ϕ STAR



$E_{AN} = E \angle 0$

$E_{BN} = E \angle -120$

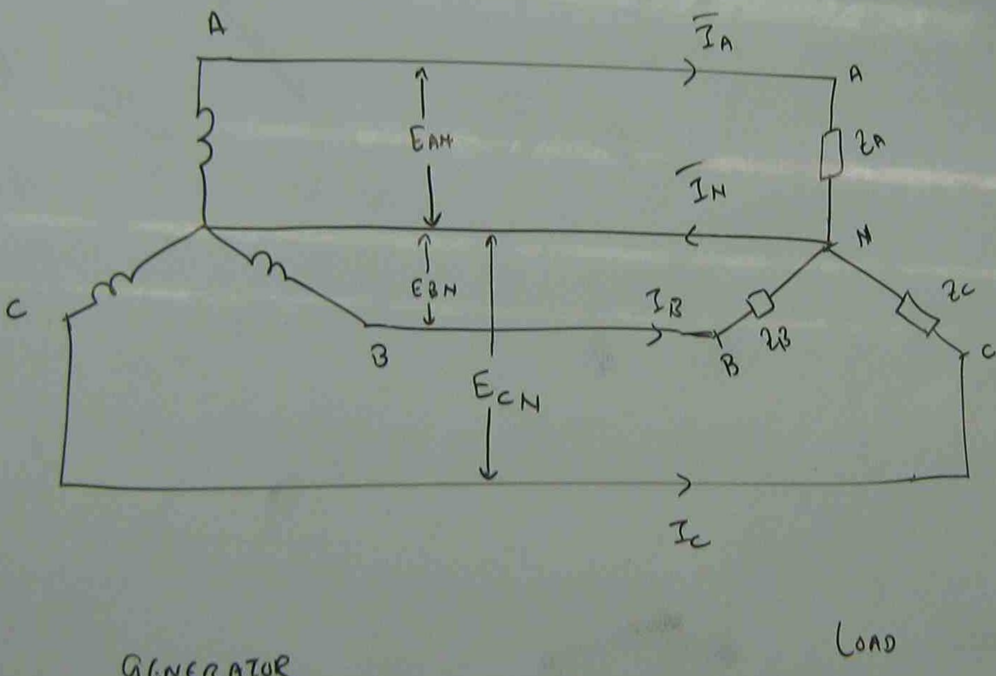
$E_{CN} = E \angle +120$

$E_{AB} = 1.7321\ E \angle 30$

$E_{BC} = 1.7321\ E \angle -90$

$E_{CA} = 1.7321\ E \angle +150$

CALCULATION OF CURRENTS IN STAR CONNECTED BALANCED LOAD



$$I_A = \frac{E_{AN}}{Z_A} = \frac{E\angle 0}{Z_A\angle\theta} = \frac{E}{Z_A}\angle -\theta$$

$$I_B = \frac{E_{BN}}{Z_B} = \frac{E\angle -120}{Z_B\angle\theta} = \frac{E}{Z_B}\angle -120-\theta$$

$$I_C = \frac{E_{CN}}{Z_C} = \frac{E\angle -240}{Z_C\angle\theta} = \frac{E}{Z_C}\angle -240-\theta$$

$$\bar{I}_N = \bar{I}_A + \bar{I}_B + \bar{I}_C = 0$$

POLAR / RECTANGULAR CONVERSION
(SOME Pb IN NEXT WEEK)

POWER SYSTEM ANALYSIS

24 | 3 | 09 T1

PRACTICAL AFTER TES

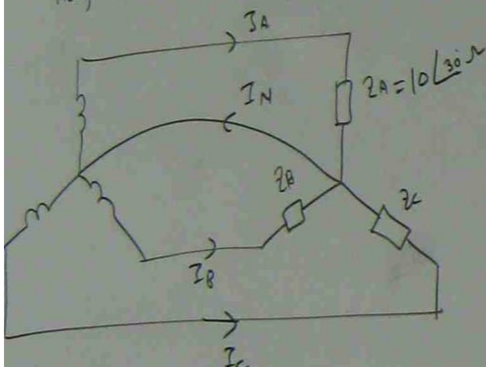
THEVENIN'S THEORM
SUPER POSITION THEORM
Y - Δ TRANSFORMATION

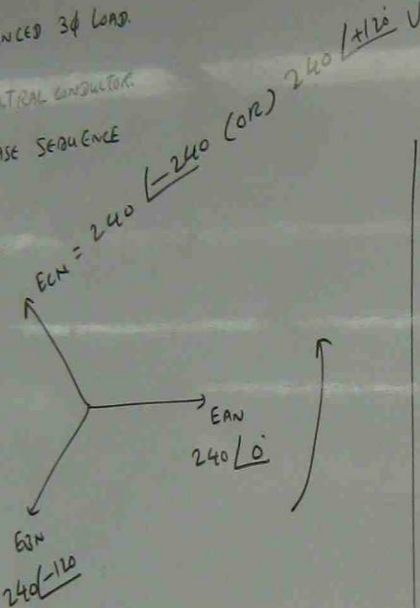
FAULT CALCULATION ..

Ph

A 4 WIRES 3φ SUPPLY IS CONNECTED TO A BALANCED 3φ LOAD. THE CONNECTION BEING THE THREE PHASE PLUS A NEUTRAL CONDUCTOR.

IF $V_{AN} = 240\angle 0$ $\quad Z_A = 10\angle 30\ \Omega$. PHASE SEQUENCE ABC, FIND I_A, I_B, I_C AND I_N





$$I_A = \frac{E_{AN}}{Z_A} = \frac{240\angle 0}{10\angle 30} = 24\angle 0-30 = 24\angle -30\ A$$

$$I_B = \frac{E_{BN}}{Z_B} = \frac{240\angle -120}{10\angle 30} = 24\angle -120-30 = 24\angle -150\ A$$

$$I_C = \frac{E_{CN}}{Z_C} = \frac{240\angle +120}{10\angle 30} = 24\angle 120-30 = 24\angle 90\ A$$

$$I_N = I_A + I_B + I_C$$

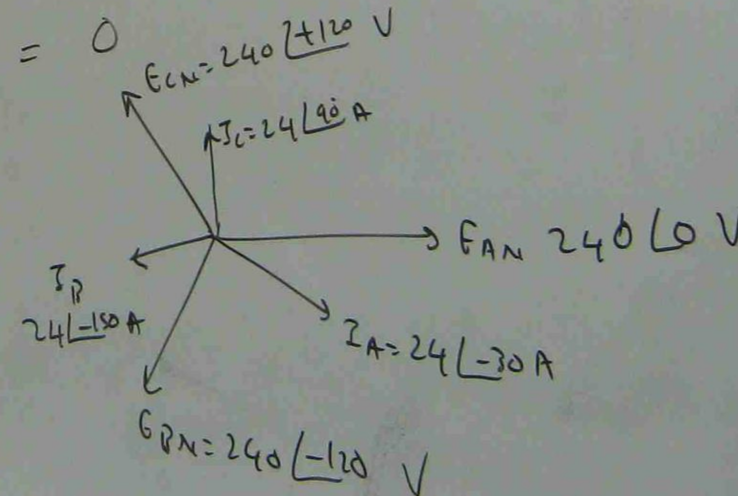
$$= 24\angle -30 + 24\angle -150 + 24\angle 90$$

$$= 24(\cos(-30) + j\sin(-30)) + 24(\cos(-150) + j\sin(-150))$$

$$+ 24(\cos 90 + j\sin 90)$$

$$= 20.78 - j12 + (-20.78 - j12) + j24$$

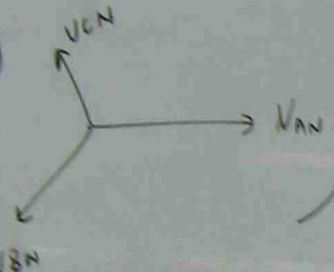
$$= 0$$



EFFECT OF PHASE REVERSAL ON STAR LOAD CURRENTS

SEQUENCE ABC

+ IVE SEQUENCE



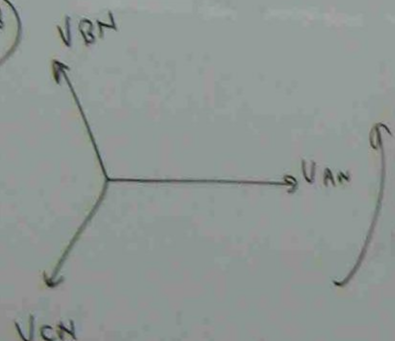
$V_{AN} = V\angle 0$

$V_{BN} = V\angle -120$

$V_{CN} = V\angle +120$

SEQUENCE ACB

— IVE SEQUENCE



$V_{AN} = V\angle 0$

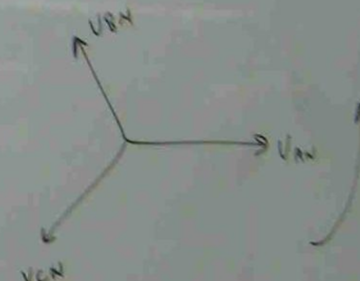
$V_{BN} = V\angle +120$

$V_{CN} = V\angle -120$

IF NEGATIVE SEQUENCE HAPPENS IN PREVIOUS PROBLEM, DETERMINE THE PHASOR DIAGRAM OF LINE CURRENTS.

$V_{AN} = 240\angle 0 \qquad Z_A = 10\angle 30\ \Omega$

NEGATIVE SEQUENCE $\longrightarrow$ ACB



$V_{AN} = V\angle 0 = 240\angle 0$

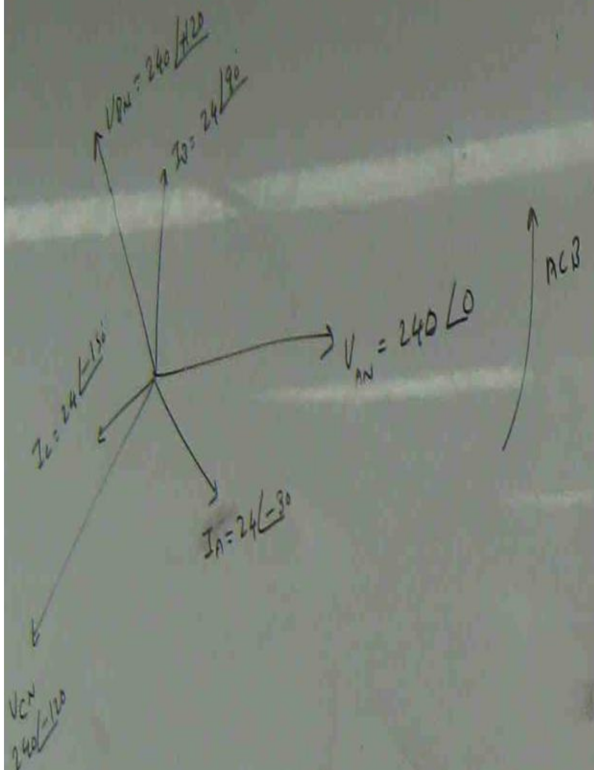
$V_{CN} = 240\angle -120$

$V_{BN} = 240\angle +120$

$$I_A = \frac{V_{AN}}{Z_A} = \frac{240\angle 0}{10\angle 30} = 24\angle 0-30 = 24\angle -30\ A$$

$$I_B = \frac{V_{BN}}{Z_B} = \frac{240\angle 120}{10\angle 30} = 24\angle 120-30 = 24\angle 90$$

$$I_C = \frac{V_{CN}}{Z_C} = \frac{240\angle -120}{10\angle 30} = 24\angle -120-30 = 24\angle -150$$



HOME WORK EXERCISE

1. 3 IDENTICAL IMPEDANCES OF $17\angle -30^\circ\ \Omega$ ARE CONNECTED TO A 415V 3ϕ 4 WIRE SUPPLY.

THE LOAD IS CONNECTED IN STAR AND PHASE SEQUENCE IS ABC. FIND THE LINE CURRENT AND DRAW THE PHASOR DIAGRAM.