UNIT- III

ANALYSIS OF TRANSMISSION LINES.

Transmission line has 3 parameters R, L & C. which are uniformly distributed along the length of the line.

Resistance and inductance form the series impedance. The capacitance exists b/w conductors in single phase line but in 3 ϕ line, conductor to neutral forms a shunt pattern throughout the line.

Taking capacitance is to account, the overhead lines are classified as

- Short tr. line
- Medium tr line
- Long tr. line

* Short Tr. line.

If the length of tr. line is < 50 km and the line voltage is < 20 kV, then it is considered to be short Tr. line

The capacitance effect will be small and hence can be neglected. only resistance & inductance are considered.

* Medium Tr. line

If the length of the Tr. line is b/w 80 km to 250 km and the line voltage is b/w 20 kv to 100 KV.

The capacitance effect are taken into account. The medium Tr. lines are represented in 2 model.

* Nominal T model
* " π model

* Long Tr. lines.

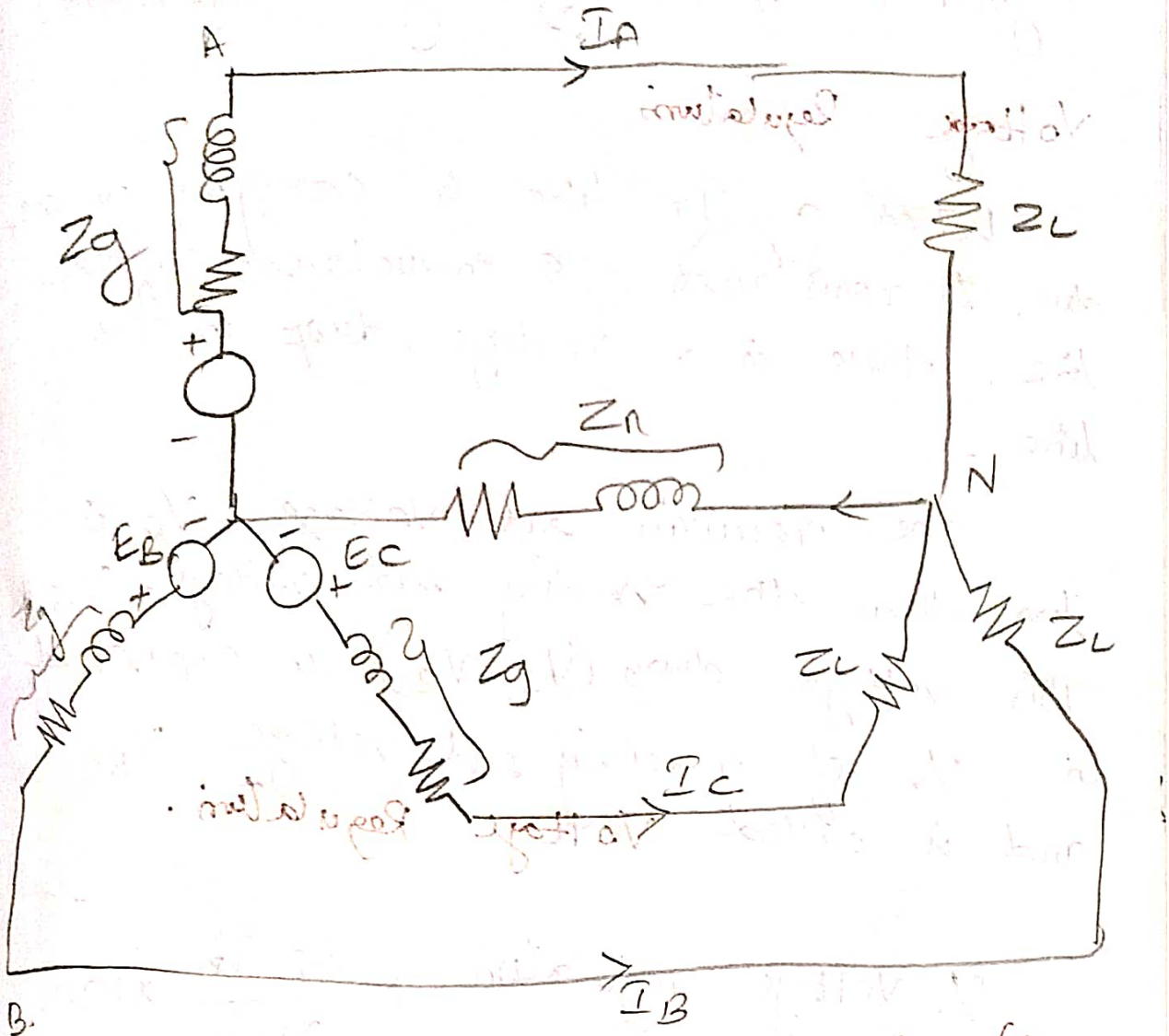
If length of Tr. lines is > 250 km and line voltage is > 100 KV

To Analyse these type of lines, the line parameters are considered to be uniformly distributed.

This also has two models.

* Nominal T method
* " π method

Tr. Line Representation



3 ϕ Balanced Y Connected N/w

It is assumed that all given voltages are line to line voltage and all currents are line currents.

where E – per phase voltage

I – " " current

R – " " Resistance

X – " " inductive reactance

Z – series impedance

Y – shunt admittance

In performance of Tr. line, Voltage regulation & tr. efficiency is important.

Voltage Regulation

When a Tr. line is carrying current due to resistance & inductance of the line, there is a voltage drop in the line.

The receiving end voltage V_R is less than the sending end voltage V_S. This voltage drop $(V_S - V_R)$ is expressed in % of receiving end voltage V_R and is called Voltage Regulation.

$$\% \text{ Voltage regulation} = \frac{V_S - V_R}{V_R} \times 100.$$

Tr. efficiency

At the receiving end of Tr. line, the power obtained is less than the sending end power, due to losses in the line resistance.

Transmission efficiency is defined as the ratio of receiving end power to sending end power of a Tr. line.

$$\eta = \frac{\text{Receiving end power}}{\text{Sending end power}} \times 100$$

$$= \frac{V_R I_R \cos\phi_R}{V_S I_S \cos\phi_S} \times 100.$$

Where voltage, current & Power factor.