SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 19EET302/ Power System 1

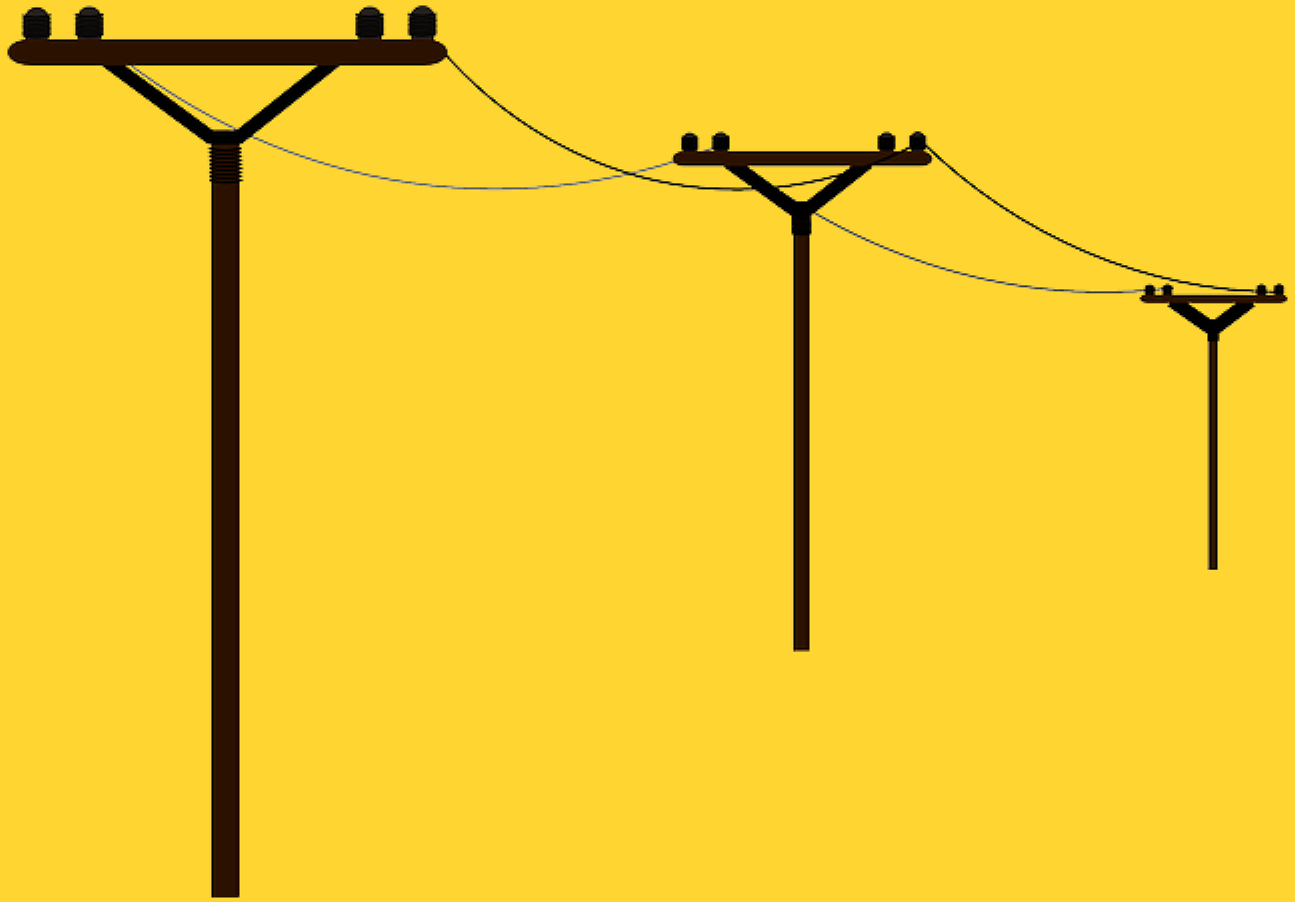
III YEAR / V SEMESTER

Unit 2 – POWER SYSTEM MODELLING

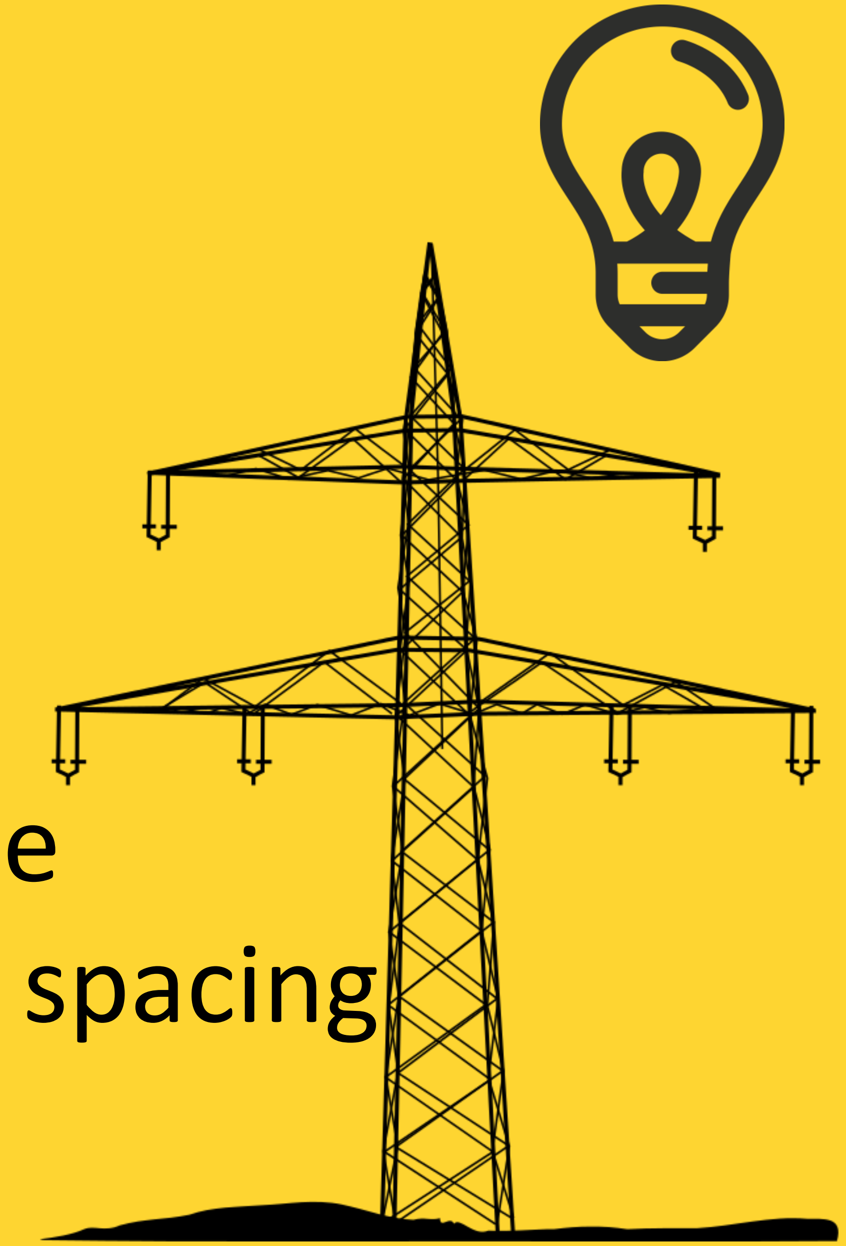
Topic 1: Modelling of medium transmission lines-Nominal T method

What We'll Discuss

TOPIC OUTLINE

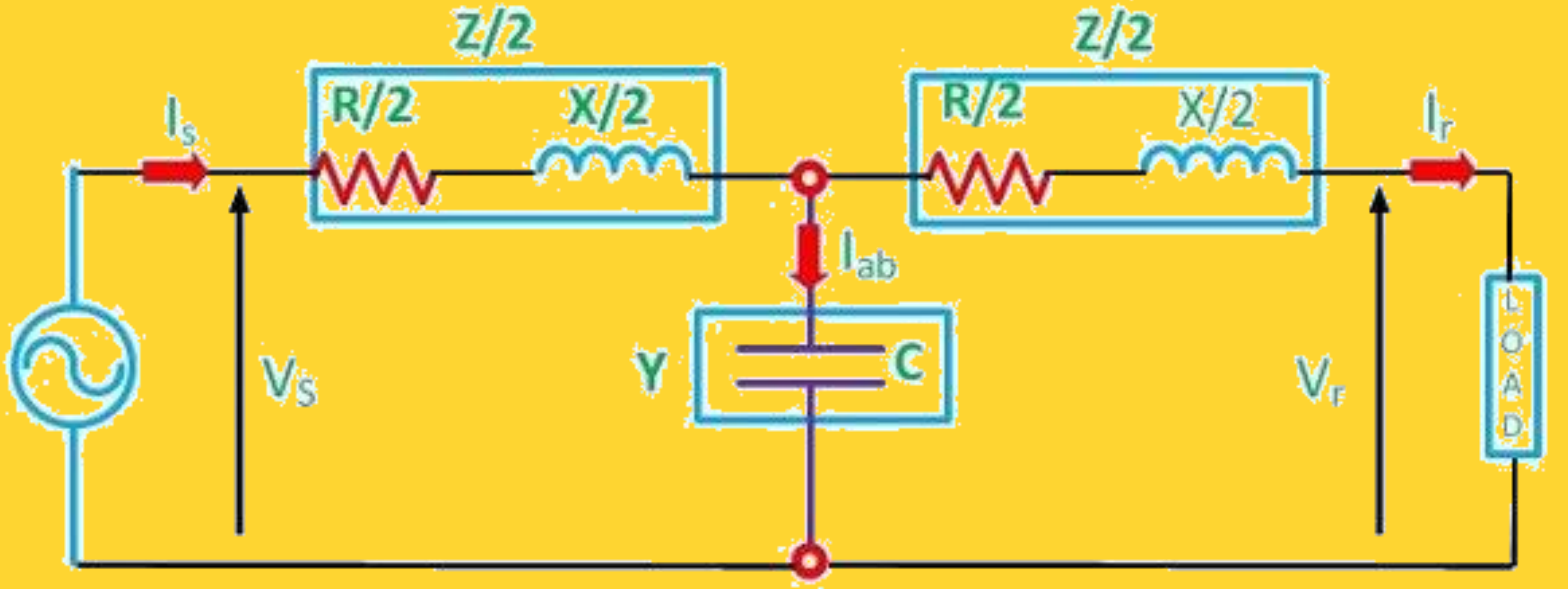


- Guess the topic
- Inductance of Three phase overhead line Symmetrical spacing
- Applications

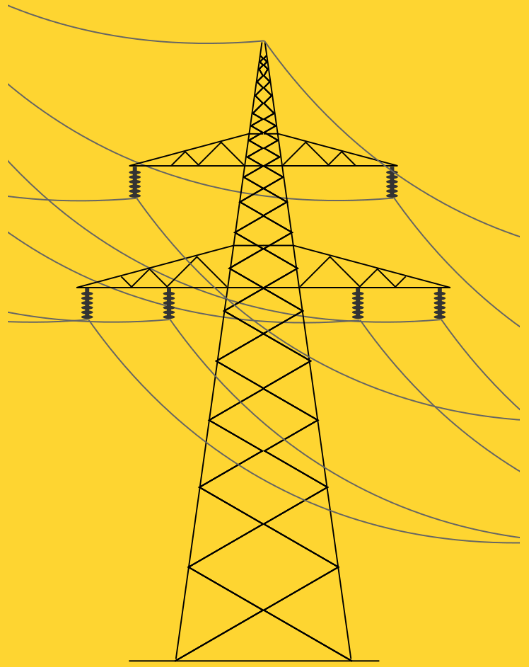


Medium Lines - Nominal T Model

In a nominal T model of a medium transmission line, the series impedance is divided into two equal parts, while the shunt admittance is concentrated at the centre of the line.



Nominal T model of a Medium Line



Medium Lines - Nominal T Model

Sending end voltage and current can be obtained by application of KVL and KCL. to the circuit shown below

$$V_{ab} = V_r + \frac{Z}{2} I_r$$

Current in the capacitor can be given as,

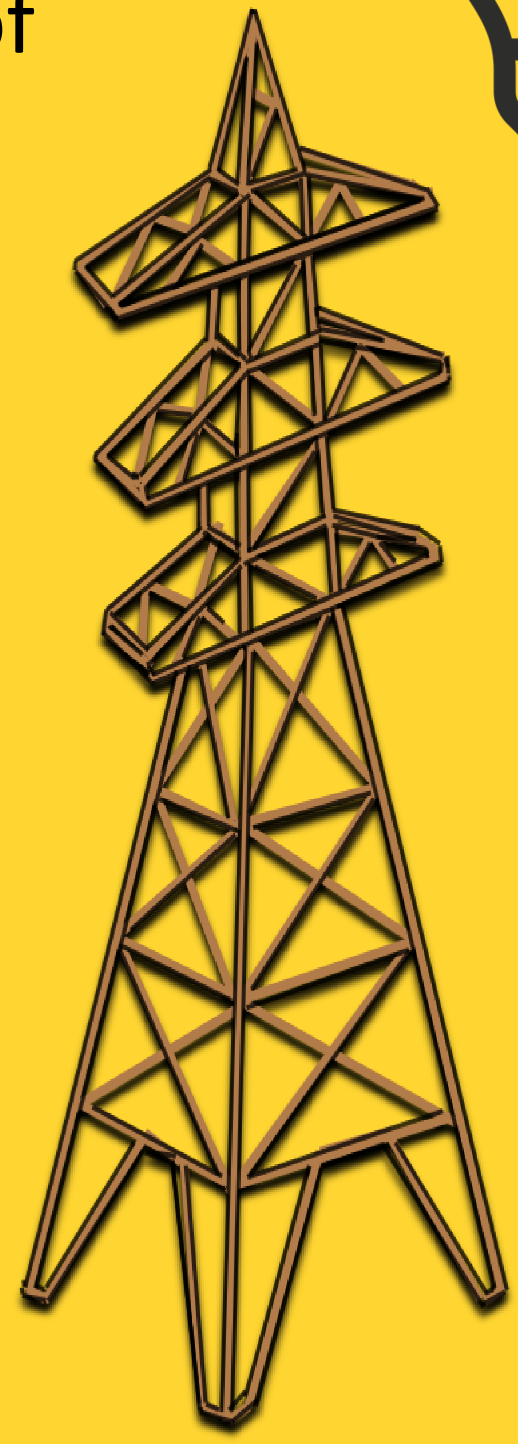
$$I_{ab} = \frac{V_{ab}}{Z_{ab}} = YZ_{ab}$$

$$I_s = I_r + I_{ab}$$

By Kirchoff's current law at node a,

$$I_s = I_r + YV_{ab}$$

$$I_s = I_r + Y\left(V_r + \frac{Z}{2} I_r\right)$$



Medium Lines - Nominal T Model

By Kirchoff's voltage law

$$V_s = V_{ab} + \frac{Z}{2} I_s$$

$$V_s = V_r + \frac{Z}{2} I_r + \frac{Z}{2}\left[Y V_r + \left(1 + \frac{ZY}{2}\right) I_r\right]$$

Equation of Sending end voltage Vs and current Is can be written in the matrix form

$$\begin{bmatrix} V_s \\ I_s \end{bmatrix} = \begin{bmatrix} 1 + \frac{ZY}{2} & Z\left(1 + \frac{ZY}{4}\right) \\ Y & 1 + \frac{ZY}{2} \end{bmatrix} \begin{bmatrix} V_r \\ I_r \end{bmatrix}$$

$$\begin{bmatrix} V_r \\ I_r \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_r \\ I_r \end{bmatrix}$$

Hence, the ABCD constant of the nominal T-circuit model of a medium line are

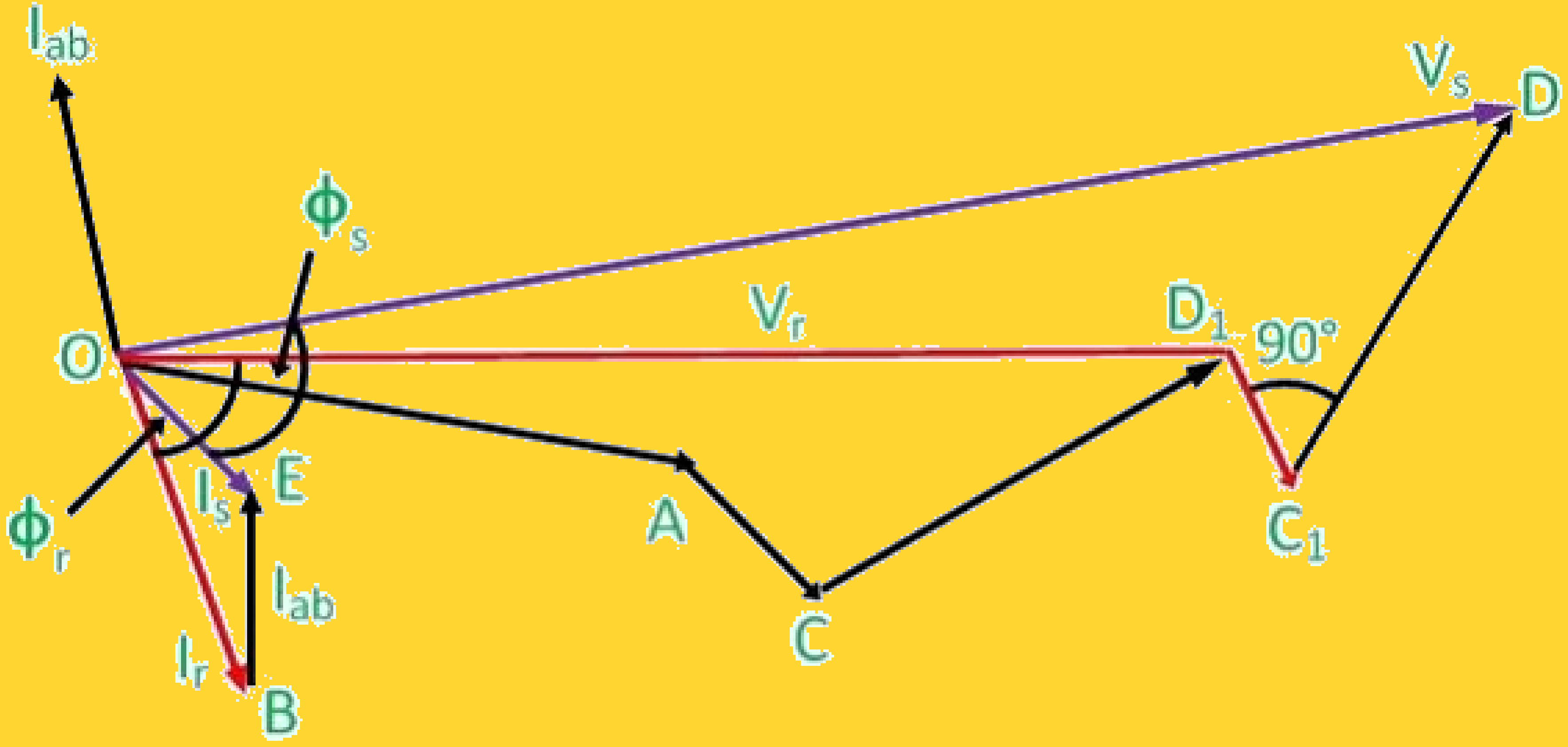
$$A = D = 1 + \frac{ZY}{2}$$

$$B = Z\left(1 + \frac{ZY}{4}\right)$$

$$C = Y$$

Phasor Diagram - Nominal T Model

The phasor diagram of the nominal T-circuit is shown below. It is drawn for a lagging power factor.



Phasor diagram of a nominal T network

Phasor Diagram Parameters

OA = Vr – receiving end voltage to neutral. taken as a reference phasor.

OB = Ir – load current lagging behind Vr by an angle ∅.

AC = IrR/2 – Voltage drop in the reactance of the right-hand half of the line.

OD1 = Vab – voltage at the midpoint of the line across the capacitance C.

BE = Iab – current in the capacitor. It leads the voltage Vab by 90

.

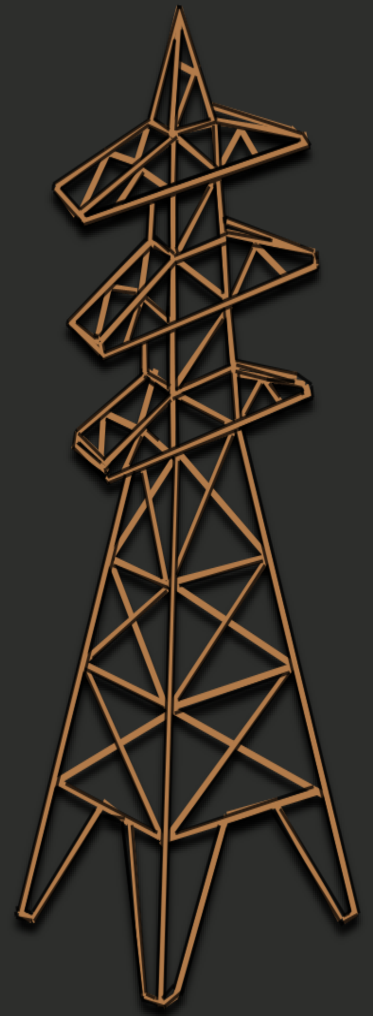
OE = Is -sending-end current, the phasor sum of load current and capacitor current.

Phasor Diagram Parameters

D1C1 = IsR/2 – voltage drop in the resistance on the left-hand side of the lines

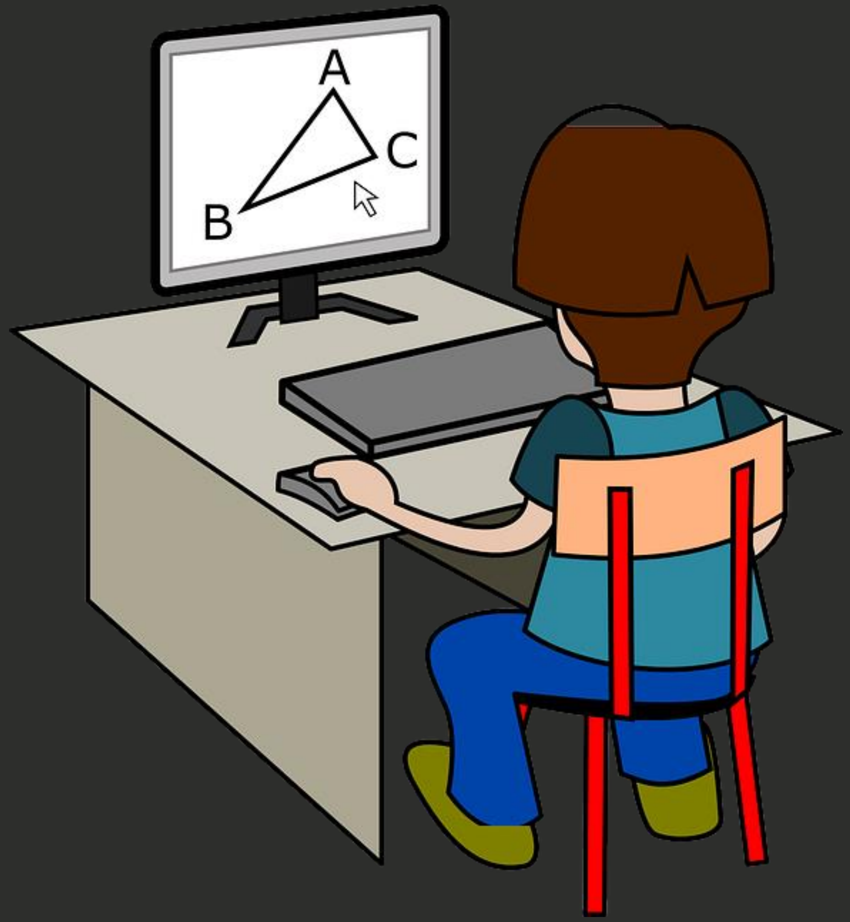
C1D = Is X/2 – voltage drop in the reactance in the left half of the line.

OD = Vs – sending end voltage. It is the phasor sum of the of Vab and the impedance voltage drop in the left-hand half of the line



Øs – phase angle at the sending end. cosØs is the power factor at the sending end of the line..

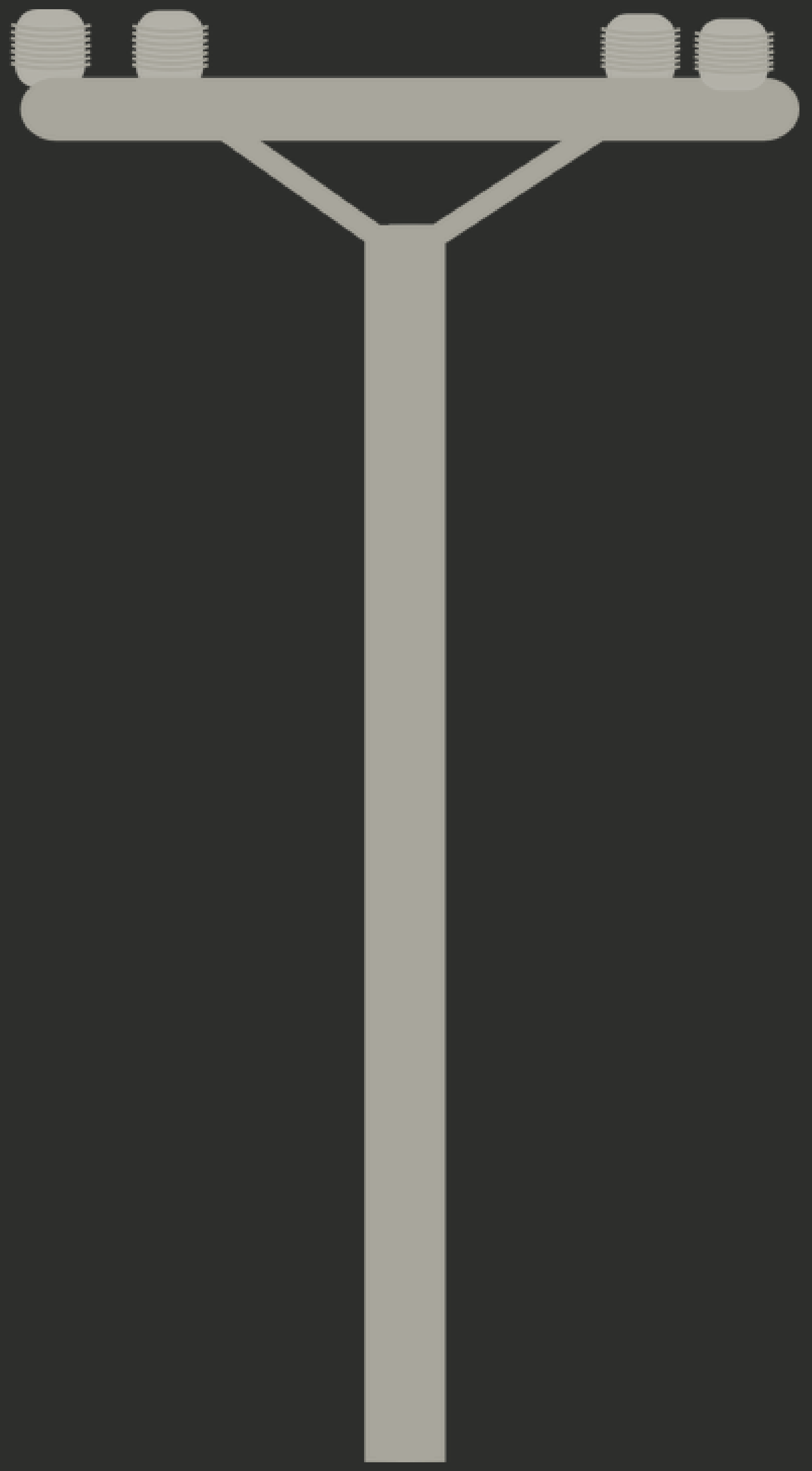
FROM THEORY TO PRACTICE



Practical Applications

RECALL TIME

ASSESSMENT TIME



THANK YOU