



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

An Autonomous Institution

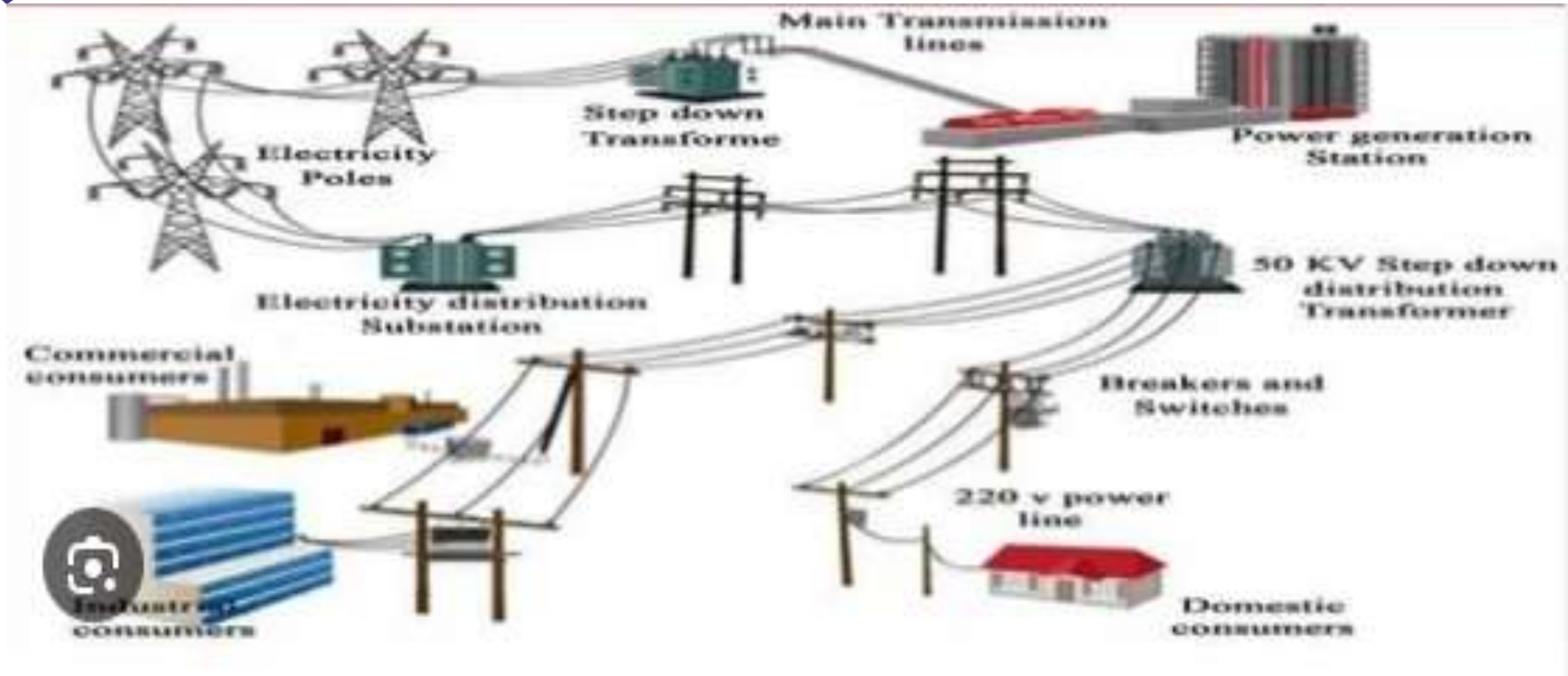
Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai



DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT – I

Representation of Power System Per Unit System





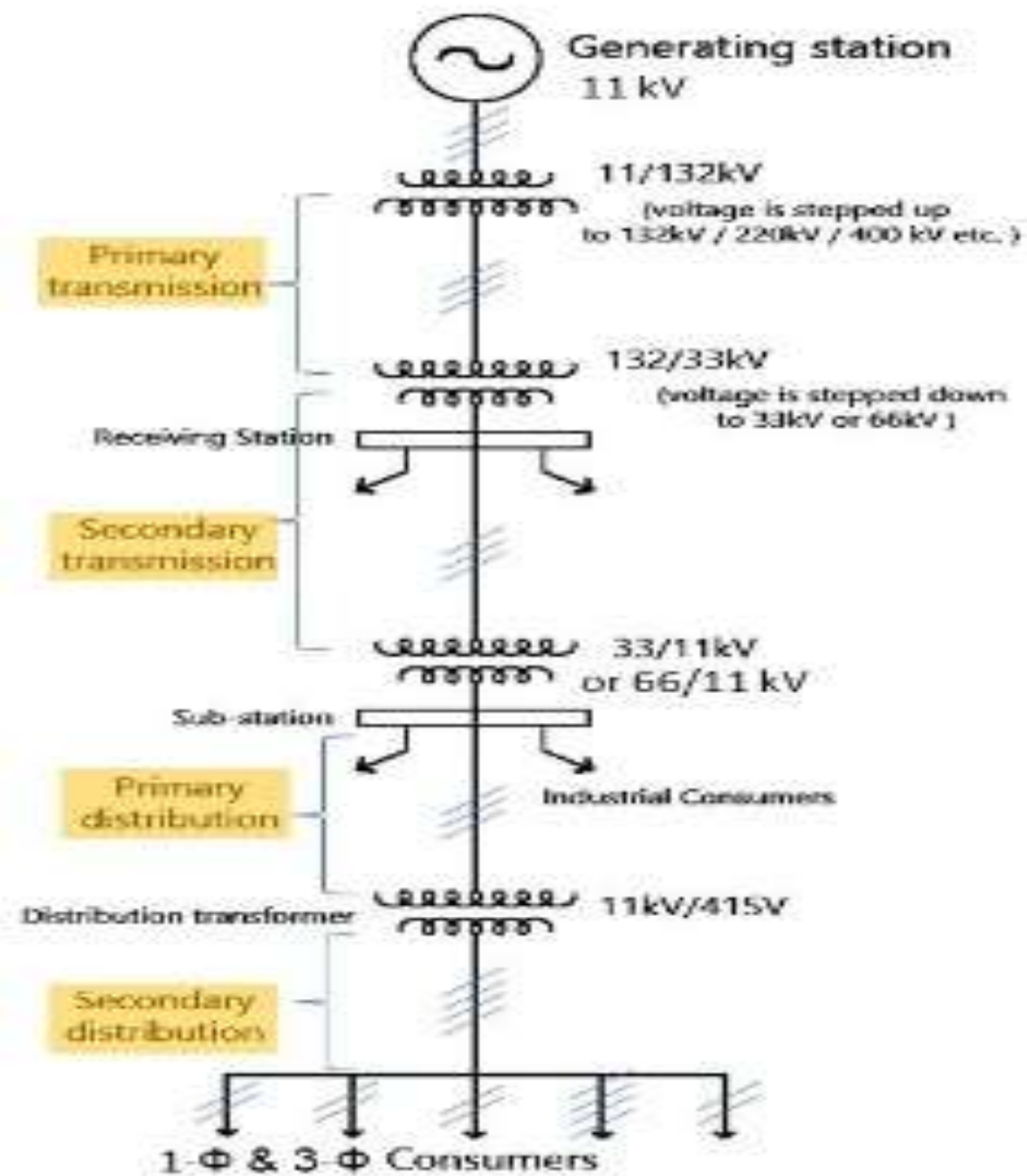
INTRODUCTION



- A Power System mainly consists of generating stations, transmission lines and distribution systems.
- Generating stations and distribution systems are connected through transmission lines , which also connects one power system to grid.
- A distribution system connects all loads in a particular area to the transmission lines.



SINGLE LINE DIAGRAM





PER UNIT QUANTITIES

- A key problem in analyzing power system is the large number of transformers.
 - It would be very difficult to continually have to refer impedances to the different sides of the transformer.
- This problem is avoided by normalization of all variables.
- This normalization is known as per unit analysis.

$$\text{Per Unit KV} = \frac{\text{Actual KV}}{\text{Base KV}}$$



ADVANTAGES OF PER UNIT SYSTEM



- The per unit values for transformer impedance voltage and current are identical when referred to primary and secondary (no need to reflect impedances from one side to other , the transformer is a single impedance).
- The per unit values of various components lie within a narrow range regardless of the equipment rating.
- The per unit value clearly represent the relative values of the circuit quantities. Many of the ubiquitous scaling constants are eliminated.
- Ideal for simulations



PROCEDURE FOR PER UNIT CONVERSION



1. Pick a 1ϕ VA base for the entire system, S_B
2. Pick a voltage base for each different voltage level, V_B . Voltage bases are related by transformer turns ratios. Voltages are line to neutral.
3. Calculate the impedance base, $Z_B = (V_B)^2/S_B$
4. Calculate the current base, $I_B = V_B/Z_B$
5. Convert actual values to per unit

Note, per unit conversion on affects magnitudes, not the angles. Also, per unit quantities no longer have units (i.e., a voltage is 1.0 p.u., not 1 p.u. volts)



ASSESSMENT



1. A three phase generator with rating 1000kVA, 33kV has its armature resistance and synchronous reactance as 20Ω /phase and 70Ω /phase . Calculate per unit impedance of the generator.

Ans:

