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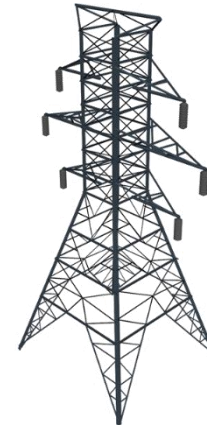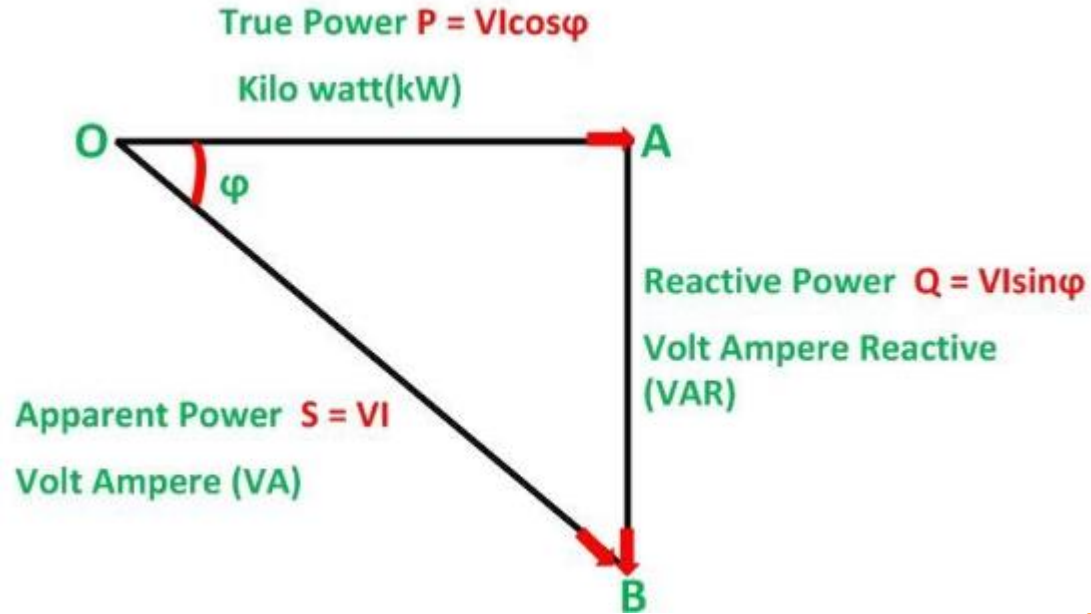**COIMBATORE-35**
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UNIT III: SPEED GOVERNING AND AUTOMATIC GENERATION

TOPIC: Generation of Real and Reactive Power

True Power $P = VI\cos\varphi$

Kilo watt(kW)

Reactive Power $Q = VI\sin\varphi$

Volt Ampere Reactive (VAR)

Apparent Power $S = VI$

Volt Ampere (VA)

Introduction

The generation of real and reactive power is a fundamental aspect of electric power systems. Real power, often measured in watts (W), is the actual power consumed by electrical devices and used to perform useful work, such as lighting bulbs, running motors, or powering electronic devices.

Reactive power, measured in volt-amperes reactive (VAR), is the power associated with the magnetic fields in inductive loads like transformers and motors.

Real Power

Real Power Generation (P): Real power is the power that is actually consumed by the loads in an electrical system. It's the power that does useful work, such as producing heat, light, or mechanical motion. Real power generation involves converting some form of energy (such as mechanical, chemical, or solar energy) into electrical energy.

This conversion typically occurs in power plants, where generators are used to produce electricity. The real power output of a generator depends on various factors including the type of generator, its design, the fuel source, and the control systems.

Reactive Power

Reactive Power Generation (Q): Reactive power is required to establish and maintain the magnetic fields in inductive loads. It doesn't perform any useful work itself but is necessary for the operation of certain types of equipment like motors and transformers. Reactive power generation is often achieved through devices called capacitors and inductors.

Capacitors generate reactive power by storing and releasing electrical energy, while inductors generate reactive power by creating magnetic fields. Reactive power generation is essential for maintaining voltage levels and ensuring the stability of the power system.

In summary, while real power is the actual power consumed by loads and performs useful work, reactive power is necessary to maintain voltage levels and support the operation of inductive loads.

Both real and reactive power are important for the efficient and reliable operation of electric power systems.

Balancing the generation and consumption of both types of power is crucial for maintaining the stability and quality of electrical grids.

Sources of Reactive Power

Reactive power is essential for maintaining voltage levels and supporting the operation of inductive loads in electrical systems. There are several sources of reactive power in power systems, including:

- **Synchronous Generators**
- **Capacitors**
- **Induction Motors**
- **Synchronous Condensers**
- **Static VAR Compensators (SVCs) & Static Synchronous Compensators (STATCOMs)**
- **Transmission Lines and Transformers**
- **Renewable Energy Sources**

Static and Dynamic analysis in Power system

Dynamic power is comprised of switching and short-circuit power; whereas static power is comprised of leakage, or current that flows through the transistor when there is no activity.

How does reactive power affect power factor?

The presence of reactive power causes the real power to be less than the apparent power, and so, the electric load has a power factor of less than 1.

Reactive power flow, however, has a number of undesirable consequences. It increases the drawn current for the same load level, which in turn increases the losses, maintenance and cost of the power system operation. Moreover, it reduces the power stability margin.
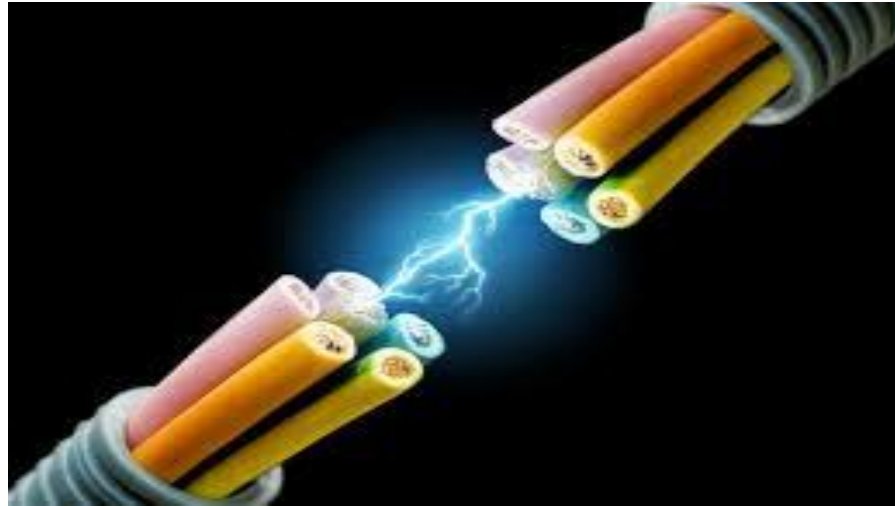
Reactive Power and its Importance:

It is used to generate electromagnetic fields for the operation of inductive loads such as motors, transformers, and transmission lines. Moreover, reactive power also provides the function of regulating voltage levels in transmission lines, ensuring a smooth supply of real power.

RECAP….

…THANK YOU