SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

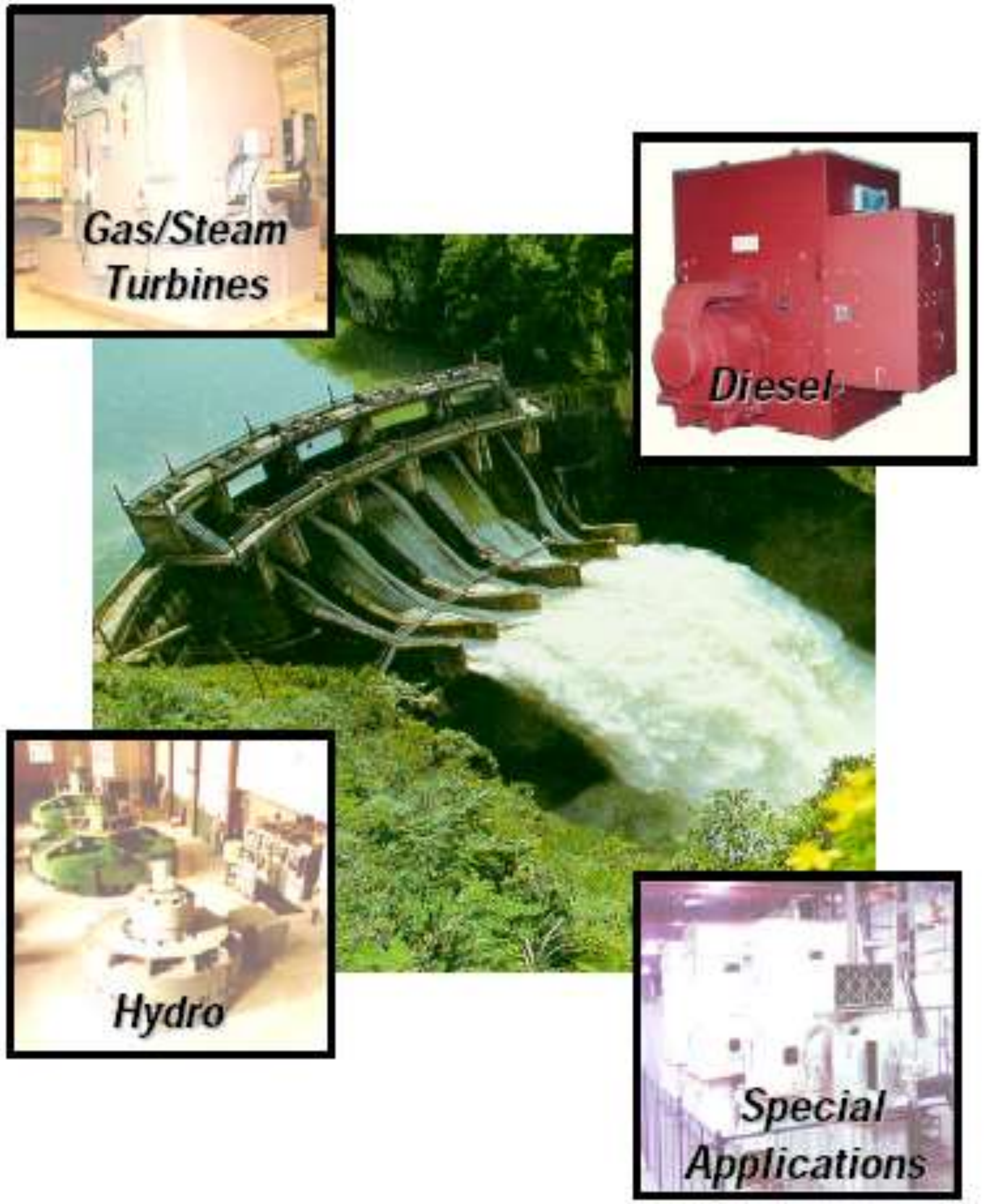
COURSE NAME: 19EET207/ SYNCHRONOUS AND INDUCTION MACHINES

II YEAR / IV SEMESTER

Unit 1 – SYNCHRONOUS GENERATOR

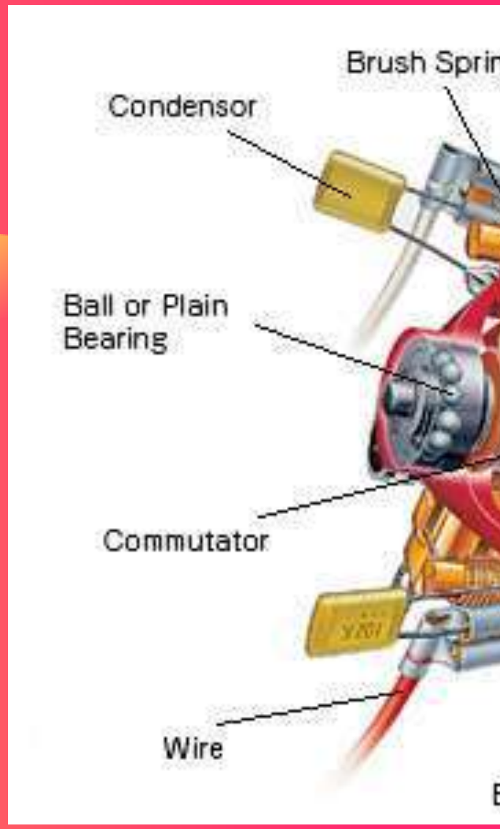
Topic 1: Constructional details-Types of rotors

GUESS THE TOPIC NAME…



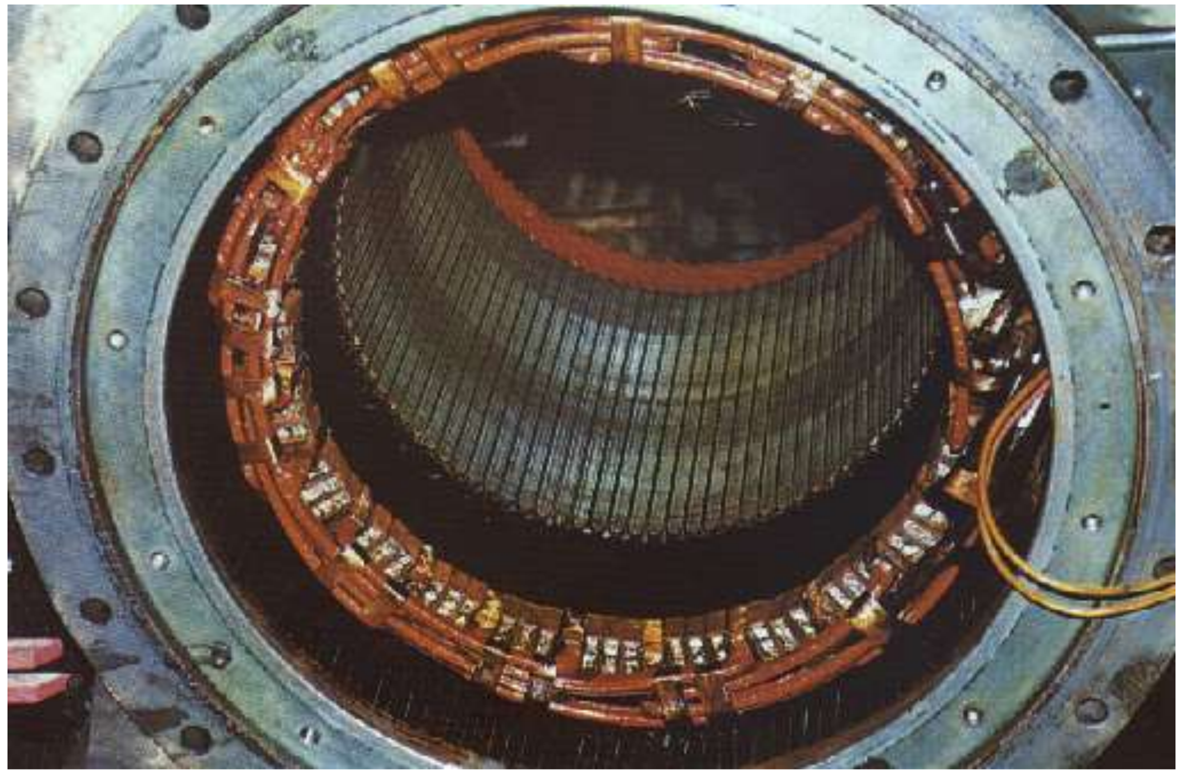
Synchronous generators

- Synchronous generators or alternators are used to convert mechanical power derived from steam, gas, or hydraulic-turbine to ac electric power
- Synchronous generators are the primary source of electrical energy we consume today
- Large ac power networks rely almost exclusively on synchronous generators
- Synchronous motors are built in large units compare to induction motors (Induction motors are cheaper for smaller ratings) and used for constant speed industrial drives



Synchronous Generator: Stator

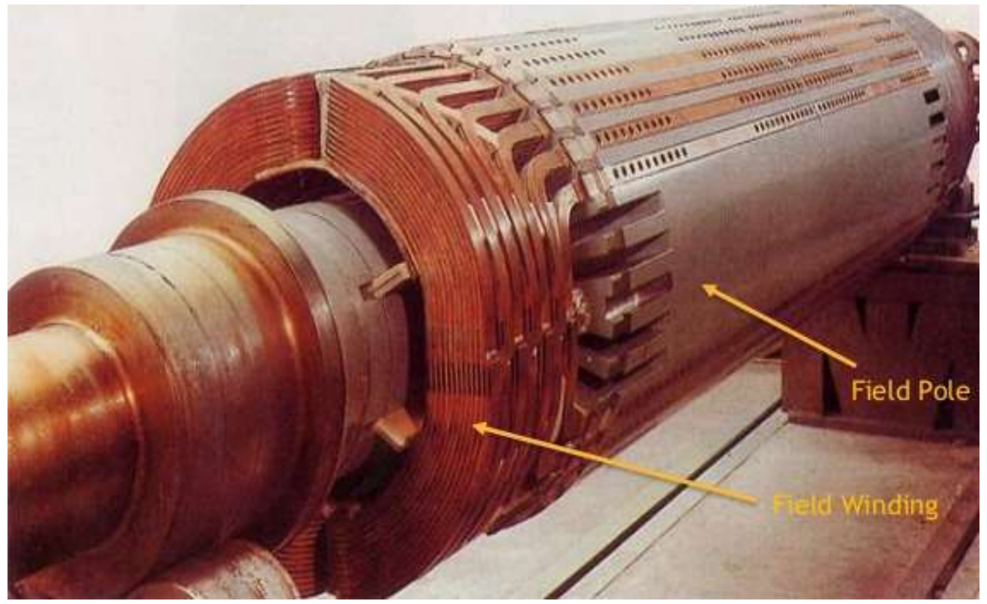
- From an electrical standpoint, the stator of a synchronous generator is identical to that of a 3-phase induction motor (cylindrical laminated core containing slots carrying a 3-phase winding).
- The nominal line voltage of a synchronous generator depends upon its kVA rating – the greater the power, the higher the voltage
- The nominal line voltage seldom exceeds 25kV, since the increased slot insulation takes up valuable space at the expense of copper conductors



Synchronous Generator: Rotor

Salient-pole rotors

- Used for low speed applications (<300rpm) which require large number of poles to achieve required frequencies (e.g. hydro turbines)



Cylindrical rotors

- Used for high-speed applications (steam/gas turbines).
- Minimum number of poles is 2, so for 50Hz the maximum speed is 3000rpm.
- High speed of rotation produces strong centrifugal forces, which impose upper limit on the rotor diameter

Field Excitation and Exciters

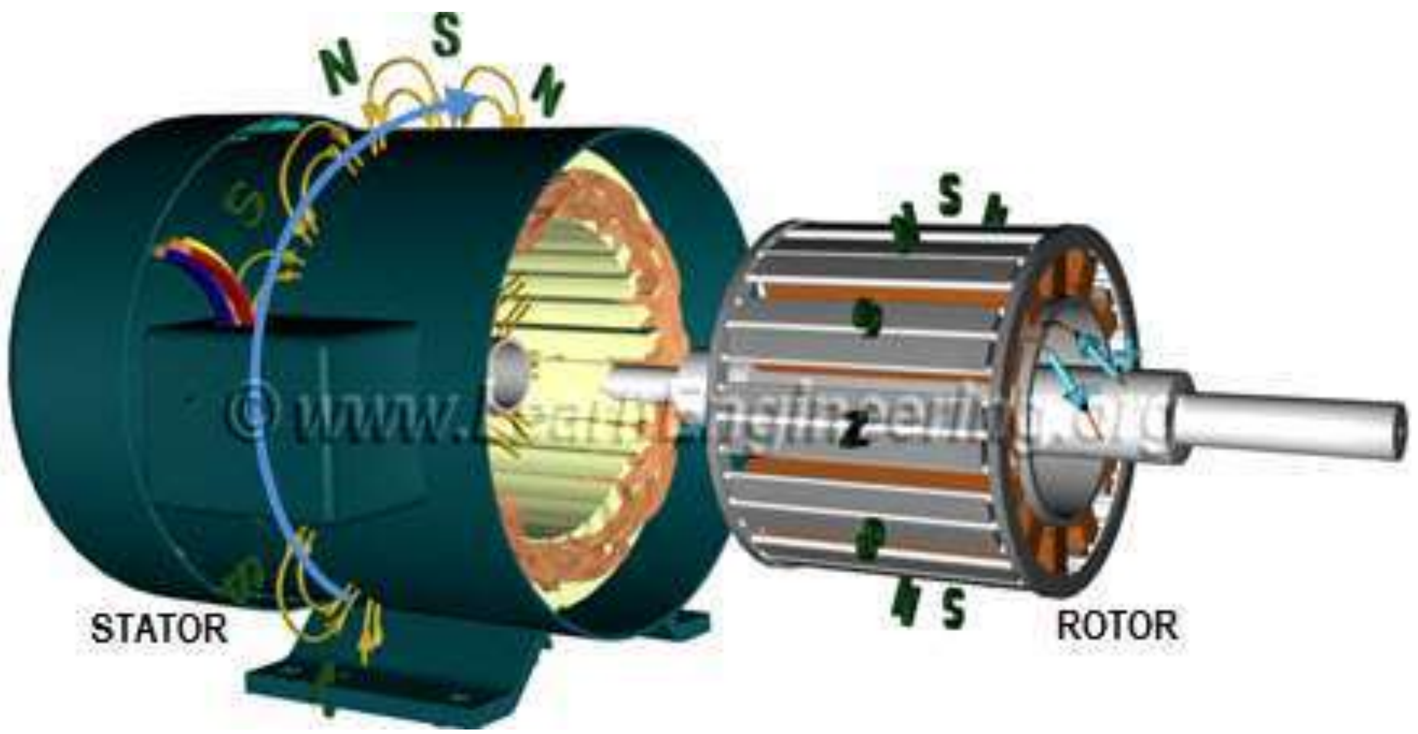
DC field excitation is an important part of the overall design of a synchronous generator

The field must ensure not only a stable AC terminal voltage, but must also respond to sudden load changes rapid field response is important.

Main and pilot exciters are used

Brushless excitation systems employ power electronics (rectifiers) to avoid brushes / slip ring assemblies.

Working Principle



The rotor of the generator is driven by a prime-mover

A dc current is flowing in the rotor winding which produces a rotating magnetic field within the machine

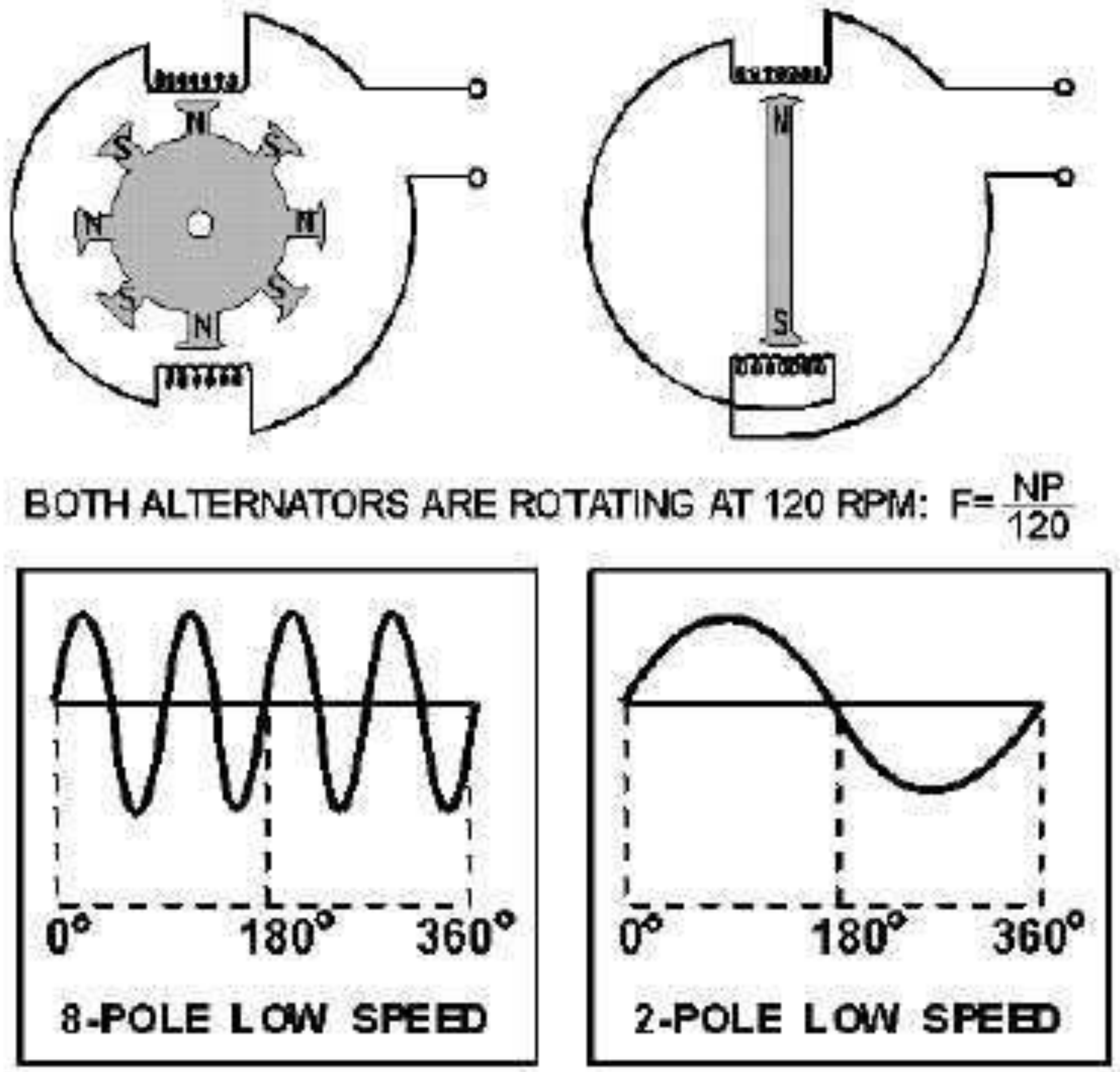
The rotating magnetic field induces a three-phase voltage in the stator winding of the generator

Electrical Frequency

Electrical frequency produced is locked or synchronized to the mechanical speed of rotation of a synchronous generator:

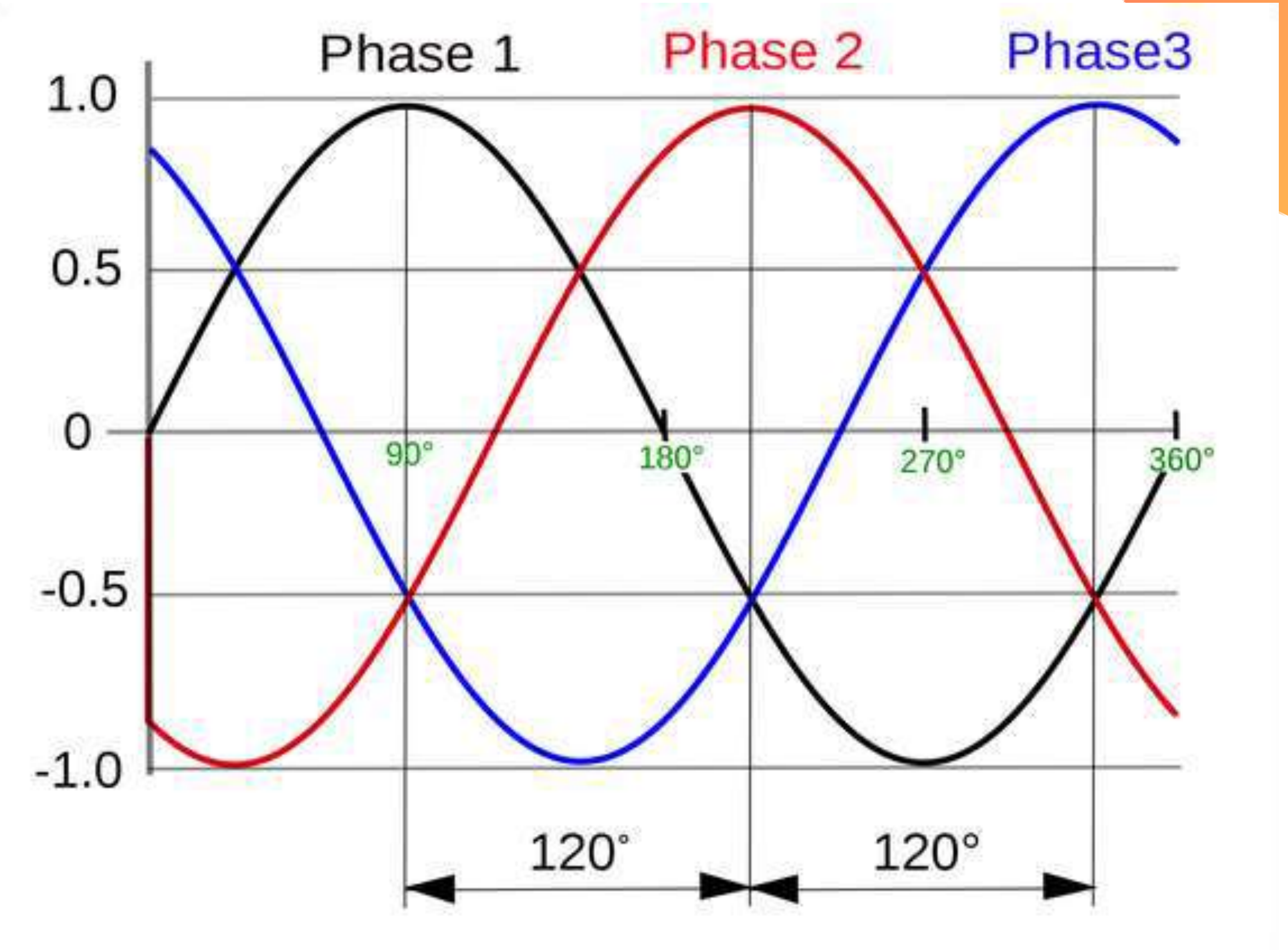
Fe= Pnm/120

where fe = electrical frequency in Hz
P = number of poles
nm= speed of the rotor in rpm



Generated Voltage

The generated voltage of a synchronous generator is given l



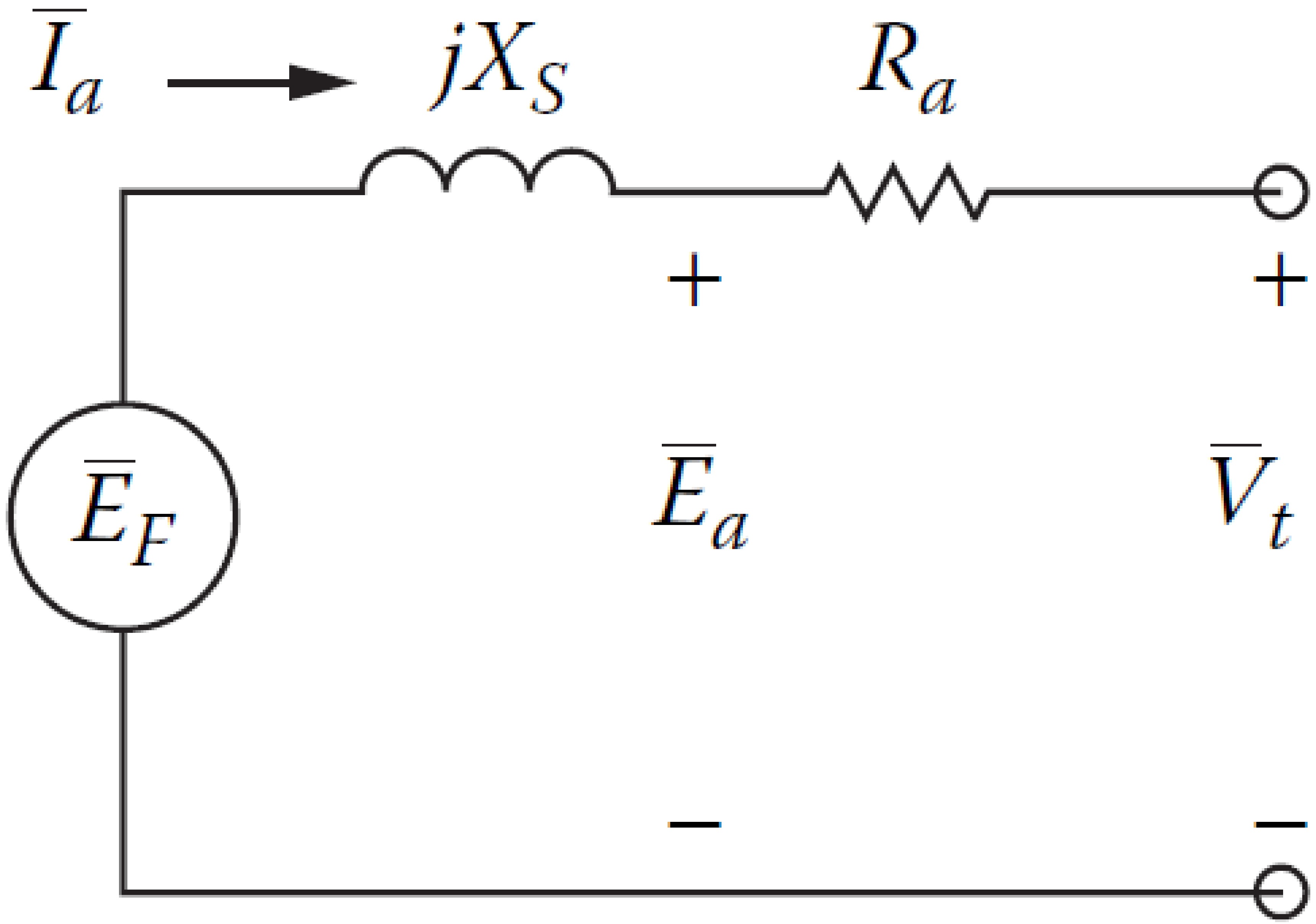
E = Kc Φ fe

f = flux in the machine (function of If)

fe = electrical frequency

Kc= synchronous machine constant

Per-phase equivalent circuit



SUMMARY

Construction, Working principle of Synchronous Generators

KEEP

LEARNING..

Thank u

SEE YOU IN NEXT CLASS