

Electrical Machines — T1

Direct Current Machines and Transformers

1. Direct Current Machines (DC Machines)

1. **Introduction to Electrical Machines**
 - Energy conversion
 - Motor vs. generator
 - Electromechanical energy conversion
2. **Construction of DC Machines**
 - Stator
 - Rotor / armature
 - Field poles
 - Field winding
 - Commutator
 - Brushes
3. **Operating Principle**
 - Faraday's law
 - Fleming's rules
 - Electromagnetic force
 - Back EMF
 - Electromagnetic torque
4. **DC Generators**
 - Generated EMF
 - EMF equation
 - Types of excitation:
 - Separately excited
 - Shunt
 - Series
 - Compound
 - Generator characteristics
5. **DC Motors**
 - Operating principle
 - Voltage equation
 - Back EMF
 - Torque equation
 - Speed equation
 - Motor characteristics
6. **Starting and Speed Control**
 - Starting current
 - Starting resistance
 - Speed control by:
 - Armature voltage
 - Field flux
 - Armature resistance
7. **Losses and Efficiency**
 - Copper losses
 - Iron/core losses

- Mechanical losses
 - Stray losses
 - Efficiency
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2. Transformers

- 1. Introduction to Transformers**
 - Definition
 - Applications
 - Principle of electromagnetic induction
- 2. Construction**
 - Magnetic core
 - Primary winding
 - Secondary winding
 - Insulation
- 3. Ideal Transformer**
 - Ideal assumptions
 - Turns ratio
 - Voltage ratio
 - Current ratio
 - Power relationship
- 4. Practical Transformer**
 - Winding resistance
 - Leakage flux
 - Leakage reactance
 - Magnetizing current
 - Core losses
- 5. Equivalent Circuit**
 - Equivalent resistance
 - Equivalent reactance
 - Magnetizing branch
 - Equivalent impedance
- 6. Transformer Tests**
 - Open-circuit test
 - Short-circuit test
 - Determination of equivalent-circuit parameters
- 7. Efficiency and Voltage Regulation**
 - Copper losses
 - Core losses
 - Efficiency
 - Voltage regulation
 - Maximum efficiency condition