

Proposed Relevant Outline

1. Introduction to Direct Current (DC) Machines
 - Historical development of DC machines
 - Applications and importance in electrical engineering
2. Constructional Features of DC Machines
 - Magnetic frame and field system
 - Armature core and windings
 - Commutator and brush assembly
3. Principle of Operation
 - Electromagnetic induction
 - Fleming's rules
 - Generator and motor action
4. EMF Equation of DC Generators
 - Derivation of EMF equation
 - Factors affecting generated voltage
5. Types of DC Generators
 - Separately excited generators
 - Shunt, series, and compound generators
 - Characteristics of DC generators
6. Armature Reaction and Commutation
 - Effects of armature reaction
 - Methods of improving commutation
7. DC Motors: Fundamentals
 - Torque equation
 - Speed control principles
 - Power flow and losses
8. Types of DC Motors and Characteristics
 - Shunt motors
 - Series motors
 - Compound motors
 - Speed–torque characteristics
9. Starting and Speed Control of DC Motors
 - Motor starters
 - Speed control methods
10. Losses, Efficiency, and Testing of DC Machines
 - Copper and iron losses
 - Efficiency calculations
 - Testing methods
11. Special DC Machines
 - Permanent magnet DC motors
 - Applications in industry
12. Maintenance and Performance Analysis
 - Heating and cooling
 - Faults and troubleshooting