

A LABORATORY COURSE IN ELECTRICAL MACHINES

CHAPTER 1 General Instructions

- 1.1 Safety of Personnel
- 1.2 Instructions for Practical Work
- 1.3 Machine Specifications
- 1.4 Selection of Instruments
- 1.5 Report Writing

CHAPTER 2 Measuring Instruments

- 2.1 General
- 2.2 Controlling Force
- 2.3 Damping Force
- 2.4 Ammeters and Voltmeters
 - 2.4.1 Permanent Magnet Moving-Coil Type
 - 2.4.2 Rectifier Type
 - 2.4.3 Moving-Iron Types
 - 2.4.4 Dynamometer Type
- 2.5 Wattmeters
 - 2.5.1 Single-Phase Wattmeter
 - 2.5.2 Low Power Factor Wattmeter
- 2.6 Power Measurement in Three-Phase Circuits
 - 2.6.1 Two-Wattmeter Method
 - 2.6.2 Three-Phase Wattmeter
- 2.7 Frequency Meters
- 2.8 Power Factor Meters
- 2.9 Potential Transformers
- 2.10 Current Transformers
- 2.11 Cathode-ray Oscilloscope
- 2.12 Digital Instruments

CHAPTER 3 Auxiliary Laboratory Equipment

- 3.1 Rheostats and Resistors
- 3.2 Loading of Generators
 - 3.2.1 D.C. Generators
 - 3.2.2 A.C. Generators
- 3.3 Loading of Motors
- 3.4 Variable Auto-Transformers
- 3.5 Induction Regulators
 - 3.5.1 Single Phase Induction Regulator
 - 3.5.2 Three Phase Induction Regulator
- 3.6 Speed Measurement
 - 3.6.1 Electrical Tachometers
 - 3.6.2 Stroboscope
 - 3.6.3 Mechanical Tachometers

CHAPTER 4 Machines

- 4.1 Generator Principle
- 4.2 Construction

- 4.3 Motor Principle
- 4.4 D.C. Motor Starters
 - 4.4.1 Shunt and Compound Motor Starters
 - 4.4.2 Series Motor Starters
- 4.5 Controllers
- 4.6 Name Plate Data and Terminal Markings

CHAPTER 5 Experiments on D.C. Machines

- 5.1 Measurement of Resistances of Field and Armature Circuits
- 5.2 Operation of D.C. Shunt, Series and Compound Motors-Running and Reversing
- 5.3 Speed Control of D.C. Motors
- 5.4 No-Load Tests on Separately Excited and Shunt-Excited D.C. Generators
- 5.5 Load Tests on Separately Excited and Shunt Excited D.C. Generators
- 5.6 Load Test on Series Generator
- 5.7 Load Test on Compound Generator
- 5.8 Parallel Operation of Shunt and Compound Generators
- 5.9 Load Test on D.C. Shunt Motor and Determination of Performance Characteristics
- 5.10 Load Test on D.C. Series Motor and Determination of Performance Characteristics
- 5.11 Efficiency of D.C. Shunt Motor by Loss-Summation (Swinburne's Method)
- 5.12 Efficiency of D.C. Shunt Machines by Hopkinson's Regenerative Test
- 5.13 Efficiency of D.C. Series Machine by Field's Method
- 5.14 Rotational Losses of a D.C. Motor and Separation of Iron and Mechanical Losses by Retardation Test
- 5.15 Iron and Mechanical Losses of a D.C. Shunt Machine

CHAPTER 6 Experiments on Transformers

- 6.1 Equivalent Circuit and Voltage Regulation of a Single-Phase Transformer by Open-Circuit and Short Circuit Tests
- 6.2 Efficiency of a Transformer by Sumpner's Back-to Back Test
- 6.3 Separation of Hysteresis and Eddy Current Losses of a Transformer
- 6.4 Parallel Operation of Transformers
- 6.5 Transformation of Power From a Three-Phase System to Two-Phase System Using Scot Connected Transformers

CHAPTER 7 Experiments on Induction Machines

- 7.1 Load Test on a Three Phase Induction Motor: Determination of Performance Characteristics
- 7.2 Circle Diagram of Three Phase Induction Motor from No Load and Blocked Rotor Tests
- 7.3 Equivalent Circuit of a Single Phase Induction Motor from No-Load and Blocked Rotor Tests

CHAPTER 8 Experiments on Synchronous Machines

- 8.1 Voltage regulation of an Alternator by (i) Synchronous Impedance Method (ii) Potier Triangle Method (iii) Saturated Synchronous Reactance Method (iv) A.S.A. Method
- 8.2 Determination of Losses and Efficiency of an Alternator
- 8.3 Parallel Operation of Alternators
- 8.4 V-Curves of a Synchronous Motor

CHAPTER 9 Experiments on Special Machines

9.1 Load-Voltage Characteristics of a Cross-Field Generator

9.2 Performance Characteristics of a Schrage Motor

CHAPTER 10 Advanced Experiments

10.1 Calibration of a. d. c. Shunt Machine

10.2 Exact Equivalent Circuit of a Transformer

10.3 Effect of Connections in Three Phase Transformers on the Wave Shape of Magnetizing Current

10.4 Equivalent Circuit and Regulation of a Three Winding Transformer

10.5 Determination of Equivalent Circuit Parameters, Sequence Impedances, Stray Load Losses, Torque-Speed Curve and Temperature Rise of an Induction Motor

10.6 Determination of Reactances and Time Constants of a Salient Pole Synchronous Machine