

#### **40.** D.C. Transmission and Distribution

Transmission and Distribution of D.C. Power—Two-wire and Three-wire System—Voltage Drop and Transmission Efficiency—Methods of Feeding Distributor— D.C.Distributor Fed at One End—Uniformly Loaded Distributor— Distributor Fed at Both Ends with Equal Voltages—Uniform Loading with Distributor Fed at Both Ends—Uniform Loading with Distributor Fed at Both Ends—Concentrated and Uniform Loading with Distributor—Current Loading and Load-point Voltages in a 3-wire System—Three-wire System—Balancers—Boosters—Comparison of 2-wire and 3-wire Distribution Systems—Objective Tests

## **41.** A.C. Transmission and Distribution

General Layout of the System—Power Systems and System Networks — Systems of A.C. Distribution-Single-phase, 2wire System-Single-phase, 3-wire System-Two-phase, 3-wire System-Two-phase, 4-wire System—Three-phase, 3-wire System-Three-phase, 4-wire System—Distribution—Effect of Voltage on Transmission Efficiency -Comparison of Conductor Materials Required for Various Overhead Systems—Constants of a Transmission Line—Reactance of an Isolated Single-phase Transmission Line-Reactance of 3-phase Transmission Line—Capacitance of a Single-phase Transmission Line—Capacitance of a Three-phase Transmission Line-Short Single-phase Line Calculations— Short Three-phase Transmission Line Constants — Effects of Capacitance—Nominal T-method- "Nominal"  $\pi$ - method—Ferranti Effect-Charging Current and Line Loss of an Unloaded Transmission Line-Generalised Circuit Constants of a Transmission Line—Corona-Visual Critical Voltage—Corona Power —Disadvantages of Corona...1569-1602



... 1603 -1682



Underground Cables—Insulation Resistance of a Single-core Cable—Capacitance and Dielectric Stress— Capacitance of 3-core Belted Cables—Tests for Three-phase Cable Capacitance—A.C. Distribution Calculations—Load Division Between Parallel Lines — Suspension Insulators—Calculation of Voltage Distribution along Different Units—Interconnectors—Voltage Drop Over the Interconnector—Sag and Stress Analysis—Sag and Tension with Supports at Equal Levels—Sag and Tension with Supports at Unequal Levels-Effect of Wind and Ice — Objective Tests.

### **42.** Distribution Automation

Introduction—Need Based Energy Management (NBEM)— Advantages of NBEM-Conventional Distribution Network—Automated System — Sectionalizing Switches — Remote Terminal Units (RTU's) — Data Acquisition System (DAS) — Communication Interface — Power line carrier communication (PLCC) — Fibre optics data communication - Radio communication - Public telephone communication — Satellite communication — Polling scheme — Distribution SCADA — Man - Machine Interface — A Typical SCADA System — Distribution Automation — Load Management in DMS Automated Distribution System — Data acquisition unit — Remote terminal unit (RTU) — Communication unit — Substation Automation — Requirements — Functioning — Control system — Protective System — Feeder Automation — Distribution equipment — Interface equipment — Automation equipment — Consumer Side Automation — Energy Auditing—Advantages of Distribution Automation — Reduced line loss —Power quality — Deferred capital expenses - Energy cost reduction - Optimal energy use — Economic benefits — Improved reliability — Compatibility — Objective Tests.

1683 - 1698



## **43.** Electric Traction

General—Traction Systems—Direct Steam Engine Drive — Diesel-electric Drive-Battery-electric Drive- Advantages of Electric Traction—Disadvantages of Electric Traction — Systems of Railway Electrification—Direct Current System—Single-phase Low frequency A.C. System—Three-phase Low frequency A.C. System—Composite System —

... 1699 - 1766



Kando System-Single-phase A.C. to D.C. System-Advantages of 25 kV 50 Hz A.C. System—Disadvantages of 25kV A.C. System—Block Diagram of an A.C. Locomotive—The Tramways —The Trolley Bus-Overhead Equipment (OHE) — Collector Gear of OHE—The Trolley Collector—The Bow Collector—The Pantograph Collector — Conductor Rail Equipment—Types of Railway Services — Train Movement—Typical Speed/Time Curve— Speed/Time Curves for Different Services—Simplified Speed/Time Curve—Average and Schedule Speed — SI Units in Traction Mechanics—Confusion Regarding Weight and Mass of a Train-Quantities Involved in Traction Mechanics—Relationship Between Principal Quantities in Trapezoidal Diagram—Relationship Between Principal Quantities in Quadrilateral Diagram —Tractive Effort for Propulsion of a Train—Power Output From Driving Axles— Energy Output from Driving Axles—Specific Energy Output—Evaluation of Specific Energy Output —Energy Consumption—Specific Energy Consumption-Adhesive Weight-Coefficient of Adhesion-Mechanism of Train Movement—General Feature of Traction Motor — Speed— Torque Characteristic of D.C. Motor — Parallel Operation of Series Motors with Unequal Wheel Diameter — Series Operation of series Motor with Uneuqal Wheel Diameter — Series Operation of Shunt Motors with Unequal Wheel Diameter — Parallel Operation of Shunt Motors with Unequal Wheel Diameter — Control of D.C. Motors —Series -Parallel Starting — To find  $t_s$ ,  $t_n$  and  $\eta$  of starting — Series Parallel Control by Shunt Transition Method — Series Parallel control by Bridge Transition — Braking in Traction Rheostatic Braking—Regenerative Braking with D.C. Motors — Objective Tests.

## **44.** Industrial Applications of Electric Motors

Advantages of Electric Drive—Classification of Electric Drives —Advantages of Individual Drive—Selection of a Motor—Electrical Characteristics —Types of Enclosures—Bearings—Transmission of Power —Noise— Motors of Different Industrial Drives — Advantages of Electrical Braking Over Mechanical Braking — Types of Electric Braking—Plugging Applied to DC Motors—Plugging of Induction Motors—Rheostatic Braking—Rheostatic Braking

... 1767 - 1794



of DC Motors—Rheostatic Braking Torque—Rheostatic Braking of Induction Motors — Regenerative Braking—Energy Saving in Regenerative Braking - Objective Tests.

# **45.** Rating and Service Capacity

Size and Rating — Estimation of Motor Rating — Different Types of Industrial Loads—Heating of Motor or Temperature Rise—Equation for Heating of Motor — Heating Time Constant — Equation for Cooling of Motor or Temperature Fall — Cooling Time Constant — Heating and Cooling Curves — Load Equalization — Use of Flywheels — Flywheel Calculations — Load Removed (Flywheel Accelerating) — Choice of Flywheel — Objective Tests.

## **46.** Electronic Control of AC Motors

Classes of Electronic AC Drives — Variable-Frequency Speed Control of a SCIM—Variable Voltage Speed Control of a SCIM—Speed Control of a SCIM with Rectifier Inverter System—Chopper Speed Control of a WRIM—Electronic Speed Control of Synchronous Motors—Speed Control by Current fed D.C. Link—Synchronous Motor and Cycloconverter— Digital Control of Electric Motors — Application of Digital Control—Objective Tests.

# **47.** Electric Heating

Introduction—Advantages of Electric Heating—Different Methods of Heat Transfer — Methods of Electric Heating—Resistance Heating—Requirement of a Good Heating Element—Resistance Furnaces or Ovens—Temperature Control of Resistance Furnaces—Design of Heating Element—Arc Furnaces—Direct Arc Furnace—Indirect Arc Furnace—Induction Furnace—Vertical Core-Type Induction Furnace—Indirect Core-Type Induction Furnace—High Frequency Eddy-current Heating—Dielectric Heating—Dielectric Loss-Advantages of Dielectric Heating—Applications of Dielectric Heating—Choice of Frequency—Infrared Heating—Objective Tests.

## 48. Electric Welding

Definition of Welding—Welding Processes—Use of (xii)

... 1795 - 1822



... 1823 - 1832



... 1833 - 1860



. 1861 - 1892

Electricity in Welding-Formation and Characteristics of Electric Arc—Effect of Arc Length — Arc Blow—Polarity in DC Welding - Four Positions of Arc Welding-Electrodes for Metal Arc Welding-Advantages of Coated Electrodes—Types of Joints and Types of Applicable Welds—Arc Welding Machines—V-I Characteristics of Arc Welding D.C. Machines — D.C. Welding Machines with Motor Generator Set—AC Rectified Welding Unit — AC Welding Machines—Duty Cycle of a Welder — Carbon Arc Welding — Submerged Arc Welding — Twin Submerged Arc Welding — Gas Shield Arc Welding — TIG Welding — MIG Welding — MAG Welding—Atomic Hydrogen Welding—Resistance Welding—Spot Welding—Seam Welding—Projection Welding —Butt Welding-Flash Butt Welding-Upset Welding-Stud Welding-Plasma Arc Welding—Electroslag Welding—Electrogas Welding — Electron Beam Welding—Laser Welding—Objective Tests.



# 49. Illumination

... 1893 - 1942

Radiations from a Hot Body—Solid Angle—Definitions — Calculation of Luminance (L) of a Diffuse Reflecting Surface — Laws of Illumination or Illuminance — Laws Governing Illumination of Different Sources — Polar Curves of C.P. Distribution-Uses of Polar Curves - Determination of M.S.C.P and M.H.C.P. from Polar Diagrams—Integrating Sphere or Photometer — Diffusing and Reflecting Surfaces: Globes and Reflectors—Lighting Schemes —Illumination Required for Different Purposes — Space / Height Ratio— Design of Lighting Schemes and Lay-outs-Utilisation Factor or Coefficient of Utilization  $[\eta]$  — Depreciation Factor (p) —Floodlighting —Artificial Sources of Light — Incandescent Lamp—Filament Dimensions —Incandescent Lamp Characteristics—Clear and Inside—frosted Gas-filled Lamps—Discharge Lamps—Sodium Vapour Lamp—High-Pressure Mercury Vapour Lamp — Fluorescent Mercury— Vapour Lamps—Fluorescent Lamp—Circuit with Thermal Switch —Startless Fluorescent Lamp Circuit — Stroboscopic Effect of Fluorescent Lamps — Comparison of Different Light Sources — Objective Tests.



#### **50.** Tariffs and Economic Considerations

1943 - 2016

Economic Motive—Depreciation—Indian Currency — (xiii)

Factors Influencing Costs and Tariffs of Electric Supply —
Demand — Average Demand — Maximum Demand —
Demand Factor—Diversity of Demand—Diversity Factor —
Load Factor—Significance of Load Factor — Plant Factor
or Capacity Factor— Utilization Factor (or Plant use
Factor)— Connected Load Factor—Load Curves of a
Generating Station — Tariffs-Flat Rate—Sliding Scale —
Two-part Tariff — Kelvin's Law-Effect of Cable Insulation
—Note on Power Factor—Disadvantages of Low Power
Factor—Economics of Power Factor—Economical Limit of
Power Factor Correction — Objective Tests.

