Training Content

Introductory course:
Load Flow and Short Circuit Calculation

DAY 1

MODULE 1: Introduction to *PowerFactory*

Presentation: *PowerFactory* User Interface and Data Structure $^3/_4$ **h**

Introduction to the *PowerFactory* structure and the user interface including menus, drawing tools and output window. Use of the Data Manager to access the data. Organisation of users and projects.

Exercise: Import a project $^1/_4$ **h**

Understand the modelling concept and the graphical user interface in an existing project.

MODULE 2: Network Modelling

Presentation: Network Modelling $^1/_2$ **h**

Introduction to the data arrangement within the project: network data, diagrams, library. Concept of type and network element data. Use of the Network Model Manager to access and modify objects parameters.

Coffee break

Exercise: Creation of a Network Model $^3/_4$ **h**

Development of a high voltage network. Modelling of busbars, lines, transformers, generators and loads. Working with the graphical user interface, Data Manager and Network Model Manager.

Presentation: Options for Busbar Representation $^1/_4$ **h**

Introduction to sophisticated modelling options of substations and sites in comparison to simple busbar modelling. Detailed substation diagrams.

Exercise: Use of Substations $^1/_2$ **h**

Enhancement of the network with the replacement of busbars with substations. Reconnection of network elements. Use of bays and detailed diagrams.

Q&A session

DAY 2

MODULE 3: Load Flow Analysis

Presentation: Load Flow Analysis $^1/_2$ h

Theoretical introduction to the load flow calculation methods and settings. Results analysis and reporting. Result colouring in the single line diagram.

Exercise: Load Flow Analysis 1 h

Executing a load flow calculation and analysing the results. Results are analysed in the single line diagram, results tables and reports. Evaluation of overloading and voltage violations.

Coffee break

Presentation: Load Flow Control $^1/_2$ h

Inner and outer loops. Consideration of limits. Voltage and reactive power control. Station controller and automatic tap changer.

Exercise: Load Flow Calculation with Voltage Control 1 h

Reactive power and voltage control using synchronous generators, station controller and tap changing transformers. Reactive power limits of generators.

Q&A session

DAY 3

MODULE 4: Network Enhancement

Exercise: Network Enhancement 1 $^1/_2$ h

Expansion of an existing medium voltage network in an separate grid. Data management and diagrams for multiple grids. Defining templates.

Coffee break

MODULE 5: Short-Circuit Calculation

Presentation: Short Circuit Analysis $^1/_2$ h

Explanation and comparison of the different short circuit current calculation methods. Presentation of the application areas of short-circuit analysis for different processes such as cable dimensioning, equipment dimensioning, etc.

Exercise: Short Circuit Analysis Part I 1 h

Three-phase short circuit calculation at various locations in the network according to IEC 60909. Evaluation of thermal and mechanical stresses with regard to the network components such as cables and busbars. Dimensioning of a circuit-breaker.

Q&A session

DAY 4

Presentation: Short Circuit Analysis with the Complete Method and Earthing Concepts $^1/_2$ h

Comparison between the different calculation methods and different star point grounding concepts.

Exercise: Short Circuit Analysis Part II $\qquad$ 1 h

Short circuit analysis using the complete method and calculation of multiple faults. Exercise on dynamic voltage support.

Coffee break

Exercise: Short Circuit Analysis Part III $\qquad$ 1 h

Execution of single-phase faults in the medium-voltage network. Neutral point handling at the transformer and investigation of different earthing concepts.

MODULE 6: Connection of Grids

Exercise: Connection of Grids $\qquad$ $^1/_2$ h

Grouping of networks in different grids and diagrams, e.g. according to voltage level or regional subsystems. Connection of different grids or subsystems topologically and graphically.

Q&A session

DAY 5

MODULE 7: Network Planning

Presentation: Grid Expansion $\qquad$ $^1/_4$ h

Data management including Grids, Variations and Expansion Stages for grid expansion planning.

Exercise: Variations and Expansion Stages $\qquad$ 1 h

Grid expansion planning using Variation and Expansion Stages on the basis of the basic network. Usage of the time dependency of network changes in expansion stages. Comparison of network variations.

Presentation: Operational Planning $\qquad$ $^1/_4$ h

Usage of Operation Scenarios to consider different operating conditions and usage of Study Cases for analysing the network.

Coffee break

Exercise: Operation Scenarios $\qquad$ $^1/_2$ h

Defining Operation Scenarios in *PowerFactory* for various load and generation conditions and switching states in the grid.

Exercise: Network Analysis ¹/₂ h

Analysis of the network with the help of the defined operation scenarios and the previously prepared network expansion planning. Use of study cases to combine active operation scenarios, variations and grids for a convenient analysis of different possible scenarios.

MODULE 8: Additional Information

Presentation: Additional Information ¹/₂ h

Additional information on the base package. Tips & Tricks for working with *PowerFactory*.

Q&A session

Time Schedule (Central European Time)

	Time
First 90 minutes block	9:00
Coffee break	10:30
Second 90 minutes block	10:45
Q&A session	12:15
End of the training day	12:30