DCS450:
DCS Control Scheme Design and Implementation

Duration:	**3 Day Classroom or 20 hours Online**
Audience:	**Process Control Engineers, DCS Maintenance Technicians, Instrument Engineers**
Prerequisites:	**Some control room exposure is desirable, but not required.**
Course Material:	**PowerPoint Slides, DCS screens, Industrial Data, Calculation Procedures and Data Analysis**

Course Description and Objectives:

This course teaches you how to conceive, design and implement process control schemes inside a DCS or even a PLC. There are many DCS and PLC vendors and this course builds skills that are useful for all types and models of any DCS or PLC. Whether you work in a chemical, petrochemical, pharmaceutical, polymer, electric power, paper or really any manufacturing process, this course will teach you the skills to come up with new advanced process control ideas and schemes. The knowledge will also help in the design of controls for safer and smoother plant operation and to run the plant better, smoother and with reduced chance of mistakes, shutdowns and human error. The knowledge will help to maximize production rates, minimize utilities, speed up product grade transitions and improve key performance indicators. In an era of a lot of approaching retirees in industry and the entry of new personnel in the control room, this course is a must for any process control engineer, DCS engineer, PLC engineer or process control technician.

Learning Outcomes:

This course teaches the main components of a DCS and even a PLC. It describes the DCS and PLC architecture. It explains process control network and the concept of L0 – L5 control levels. It explains all DCS and PLC control functions. It teaches standard and custom DCS logic blocks. It covers batch, sequential, continuous and semi-batch control schemes. It teaches how to design and implement control schemes. It shows the safe and correct way of starting up advanced control schemes. It explains how to design and implement PID control, cascade PID control, feedforward control, ratio control, model-based control, adaptive control, constraint override control, production maximizing control, virtual sensors, and closed-loop control using online analyzers. There are numerous industrial examples illustrating process control problems, followed by the design and implementation.

Day 1:

DCS and PLC overview
DCS and PLC control architecture and control network
Definition and examples of primary and advanced process control
Standard function blocks available inside DCS or PLC
Custom function blocks available inside DCS or PLC
Building continuous control strategies
Building discrete control strategies
MODBUS and OPC interfaces and connectivity to DCS
Ethernet and coax-based networks
Process Control Terminal Server
DCS/PLC remote access and process control security
Dual redundant and triple redundant control schemes, 2 out of 3 voting
Programming languages used in DCSs
Selection of scan rates for different types of tags
Naming convention tips and recommendations

Day 2:
Designing advanced process control schemes inside a DCS or PLC
Lube Oil Plant APC design and implementation
Polyethylene APC design and implementation
Distillation APC design and implementation
Quarry production maximization design and implementation
Gas composition mass balance control design and implementation
Reactor heat balance calculations and yield prediction
Use of online analyzers and analyzer multiplexing
Design and implementation of furnace feedforward control
Design and implementation of ratio control and summer control
Design and implementation of closed loop cascade control using online analyzers
Compressor surge control
Control valve characterization and gain scheduling
Determining transfer function parameters
Calculating DCS tuning parameters for APC schemes based on transfer function parameters
Signal validation, frozen data alarms and spike detection and rejection

Day 3:
Median signal PV calculation
Consideration of safety and abnormal situations
Design of safe process control schemes
How to avoid mistakes and design robust control schemes
HAZOP review procedures
Safety shutdown control logic and design
Design and procedure for conducting FAT (factory acceptance tests)
Safe procedure for activating long chains of control schemes
eMOC – electronic management of change procedures
Design and implementation of batch sequence control schemes
Designing logic for automatic activation and startup of advanced control schemes
Mixing of batch control and continuous control logic for maximum effectiveness
Tips and ideas to achieve high onstream factor on DCS and PLC based control schemes
Protecting control schemes from fault, errors and problems
Enhanced alarms and user alerts
Alarm management and event analysis
Adaptive control design and implementation
Inferential control design and implementation