Domain 1  Feasibility Study:
Identify, scope, and justify the automation project.

Task 1 Define the preliminary scope through currently established work practices in order to meet the business needs.

- Automating process and/or equipment
- Automation opportunity identification techniques (e.g., dynamic performance measures)
- Basic process and/or equipment
- Control and information technologies (e.g., MES, enterprise software) and equipment
- Developing value analyses
- Established work practices
- Project management methodology and work processes

Task 2 Perform and document cost/benefit analysis of automation alternatives that meet business needs.

- Automation systems technology
- Choosing the degree of automation
- Cost/benefit analysis tools
- Evaluating project viability
- Identifying and assessing business needs

Task 3 Conduct technical studies for the preliminary automation strategy by gathering data and conducting appropriate analyses relative to requirements in order to define development needs and risks.

- Conducting risk analyses
- Defining primary control strategies
- Machine control theories and mechatronics (electro-mechanical)
- Process control theories

Task 4 Perform justification analyses by generating cost estimates using accepted feasibility and financial models to determine project viability.

- Understanding business drivers
- Costs of control equipment
- Estimating techniques to establish cost of the system
- Evaluating the results of the financial analysis for the automation portion of the project
- Financial and feasibility models (e.g., ROI, NPV, Lean Six Sigma)

Task 5 Solicit stakeholder “buy-in” by creating a conceptual summary document that reports preliminary decisions, assumptions, feasibility results, and financial justifications in order to facilitate “go/no go” decision.

- Communicating effectively with varied audiences in written or oral form
- Compiling and summarizing information effectively for varied audiences
- Data presentation tools
010504 Presenting data and results in a logical and concise manner

**Domain 2 Definition:**
Identify customer requirements and complete high-level analysis of the best way to meet those requirements.

**Task 1** Develop system and process operational strategies through discussion with key stakeholders and using appropriate documentation in order to create and communicate design requirements.

020101 Building consensus
020102 Compiling and summarizing information effectively for varied audiences
020103 Data analysis tools
020104 Effective team leadership
020105 Interpreting data
020106 Interview techniques
020107 Process and/or operations knowledge and experience

**Task 2** Analyze alternative technical solutions in order to define the final automation strategy.

020201 Automation solutions and techniques
020202 Basic control elements (e.g., sensors, instruments, actuators, control systems, drive systems, HMI, batch control, machine control)
020203 Control systems theories and applications
020204 Process and/or equipment functionality and interoperability

**Task 3** Establish detailed requirements and data including network architecture, communication concepts, safety, concepts, regulatory and industry codes and standards, preferences for instruments and equipment, reporting and information needs, and security architecture through established practices in order to form the basis of the design.

020301 Communication protocols, including field level
020302 Conducting safety analyses
020303 Control systems security practices and requirements
020304 Defining information needed for reports
020305 Determining which data is important to capture
020306 Network architecture
020307 Regulatory and industry standards and codes
020308 Safety concepts and standards (e.g., ISA, ISAM, ANSI, NFPA, OSHA, ISO, ABNT, SAC, STQC).

**Task 4** Generate focused project cost estimates by gathering cost information from internal and external sources in order to support project financing.

020401 Available templates and tools
020402 Estimating the cost of control equipment and software
020403 Evaluating project viability

**Task 5** Summarize project requirements by creating basis-of-design and user-requirements documents in order to launch the design phase.

020501 Basis-of-design outlines
020502 Communicating effectively with varied audiences in written or oral form
020503 Compiling and summarizing information
020504 User-requirements outlines and bid documents
**Domain 3  System Design:**
Prepare the complete conceptual design of the control and information systems including specifications of the hardware and software to be used in the system and complete the "detail design" and procurement of the hardware systems including preparation of construction work packages.

**Task 1** Perform safety and/or hazard analyses, security analyses, and regulatory compliance assessments by identifying key issues and risks in order to comply with applicable standards, policies, and regulations.

- 030101 Analyzing hazards
- 030102 Analyzing safety integrity levels
- 030103 Applicable electrical, mechanical, safety, environmental standards (e.g., EPA, ASME, ISA S84, IEC 61508, 21 CFR Part 11, NFPA, OSHA, UL/FM, NEMA, ISO14000, CSA, ABNT)
- 030104 Applying regulations to design
- 030105 Assessing relationships between jurisdictional standards
- 030106 Assessing security requirements or relevant security issues
- 030107 Participating in a Hazard Operability Review
- 030108 Understanding differences between standards, regulations, codes and guidance documents

**Task 2** Analyze customer design criteria and preferences using the information gathered in the definition stage and considering human-factors effects in order to establish standards, templates, and guidelines.

- 030201 Designing electrical and control systems
- 030202 Developing programming standards
- 030203 Drawing requirements (e.g., ISA 5.x)
- 030204 Electrical standards (e.g., NEC, DIN, JIS, CENELEC)
- 030205 Final control elements and other field devices
- 030206 IEC 61131 programming languages
- 030207 Instrument selection and sizing
- 030208 ISA standards (e.g., ISA88, ISA95)

**Task 3** Create detailed equipment specifications and instrument data sheets in order to purchase equipment and support system design and development, based on vendor selection criteria, characteristics, and conditions of the physical environment, regulations, and performance requirements.

- 030301 Data sheets (ISA S20.x)
- 030302 Designing electrical and control systems
- 030303 Electrical standards (e.g., NEC, IEC, SAC, STQC, CENELEC)
- 030304 Evaluating equipment alternatives
- 030305 Final control elements and other field devices
- 030306 Instrument selection and sizing
- 030307 Motor and drive selection and sizing
- 030307 Selecting and sizing control system equipment
- 030309 Selecting and sizing input/output signal devices and/or conditioners

**Task 4** Analyze the quantity, type, and flow of data involved with automation systems in order to provide specifications for hardware selection and software development.

- 030401 Data flow in control systems
- 030402 Data requirements of system to be automated
- 030403 Data structures of control systems
Task 5 Select the physical communication media, network architecture, and protocols based on data requirements in order to complete system design and support system development.

Task 6 Develop a functional description of the automation solution using rules established in the definition stage in order to guide development and programming.

Task 7 Design the test plan using chosen methodologies in order to execute appropriate testing relative to functional requirements.

Task 8 Perform the detailed design for the project by converting the engineering and system design into purchase, requisitions, drawings, panel designs, and installation details consistent with the specification and functional descriptions in order to provide detailed information for development and deployment of construction work packages.

Domain 4 Development:
Identify, develop, and implement requirements for packed software configuration and development.

Task 1 Develop Human Machine Interface (HMI) in accordance with the design documents in order to meet the functional requirements.
040101 Alarm and security schemes and features
040102 Capture, analysis, and display of trending and historical data
040103 Computer operating systems
040104 Database fundamentals
040105 Documenting the configuration and programs
040106 Human factors design (e.g., navigation menus, logical and effective data presentation)
040107 Implementing network connections and interface systems
040108 Programming structure techniques and configurations
040109 Report configurations
040110 Tag definition schemes

Task 2 Develop database and reporting functions in accordance with the design documents in order to meet the functional requirements.

040200 Develop database and reporting functions in accordance with the design documents in order to meet the functional requirements.

040201 Computer operating systems
040202 Creating reports and formatting/printing specifications for report output
040203 Data mapping
040204 Designing logical and effective reports
040205 Documenting database configuration
040206 Implementing network connections and interface systems
040207 Interpreting functional descriptions
040208 Programming structure techniques and configurations
040209 Relational database design, theory, and administration
040210 Writing database queries

Task 3 Develop control configuration or programming in accordance with the design documents in order to meet the functional requirements.

040301 Alarm and security schemes and features
040302 Computer operating systems
040303 Documenting the configuration and programs
040304 Hardware configuration and I/O structure (e.g., DCS, PLC Rack)
040305 Implementing network connections and interface systems
040306 Interpreting drawings and functional descriptions, including control strategies, logic drawings, P&IDs, and PFDs
040307 Memory addressing and tag definition schemes
040308 Process and/or equipment to be automated
040309 Programming, configuration and processor capabilities
040310 Standard nomenclature (e.g., ISA)
040311 Structured programming techniques

Task 4 Implement data transfer methodology using communications and network protocols in accordance with design documents in order to meet functional requirements.

040401 Analyzing throughput
040402 Computer operating systems
040403 Configure network products
040404 Data mapping
040405 Documenting the configuration and programs
040406 Ensuring data integrity
040407 Interfacing and systems and gateways
040408 Network protocols and topology

Task 5 Implement automation system security in accordance with the design documents in order to meet the functional requirements.

040501 Configuring/programming of security system
040502 Documenting the security configuration and programs
040503 Industry and regulatory standards (e.g., ISA 99, 21 CFR Part 11, IEEE-802)
040504 System/network security techniques

Task 6 Conduct peer reviews of configuration and programming in order to establish compliance with functional requirements.

040601 Alarming schemes
040602 Computer operating systems
040603 Documenting the configuration and programs
040604 Functional requirements of system/equipment to be automated
040605 Hardware configuration and I/O structure (e.g., DCS, PLC Rack)
040606 I/O structure
040607 Memory addressing schemes
040608 Networking and data communications
040609 Programming and/or configuration capabilities
040610 Programming structure techniques and configurations
040611 Reviewing programming/configuration for compliance with design requirements

Task 7 Conduct offline or FAT (Factory/Functional Acceptance Testing) testing of automation systems using the test plan in order to determine compliance with functional requirements.

040701 Alarm and security schemes and features
040702 Computer operating systems
040703 Documenting test results and deviations
040704 Executing test plans
040705 Functional requirements of system/equipment to be automated
040706 Hardware configuration and I/O structure (e.g., DCS, PLC Rack)
040707 I/O structure
040708 Implementing connections to remote devices
040709 Interpreting functional requirements of system/equipment to be automated
040710 Interpreting P&IDs
040711 Memory addressing schemes
040712 Networking and data communications
040713 Programming and/or configuration capabilities
040714 Testing techniques
040715 Writing FAT procedure

Task 8 Assemble all required documentation and user manuals created during the development process in order to transfer essential knowledge to customers and end users.

040801 Documenting equipment information and procedures for end users
040802 Documentation practices
040803 Functional requirements of system/equipment to be automated
040804 General understanding of automation systems
040805 Operations procedures

Domain 5 Deployment:
Develop, review, and execute all phases of project field installation, testing, and start-up.

Task 1 Review and/or perform the physical inspection process of installed equipment against construction drawings in order to ensure installation in accordance with design drawings and specifications

050101 Applicable codes and regulations (e.g., NEC, building codes, OSHA, CENELEC EN codes, applicable IEC regulations)
050102 Comparing physical implementation to drawings
050103 Construction documentation
050104 Development of discrepancy reporting process (e.g., punch lists)
050105 Installation standards and practices (e.g., field devices, computer hardware, cabling)
050106 Reconciling and reporting of redlines and other discrepancies

Task 2 Conduct site acceptance testing of communication systems and field devices in accordance with design specifications in order to ensure proper device operation.

050201 Applicable standards, regulations, and procedures relative to testing
050202 Communication networks and protocols
050203 Comparing test results to design specifications
050204 Conducting and documenting field device tests
050205 Field devices and their performance requirements
050206 Management of change procedures
050207 Test plan and methodology (e.g., loop checks, point-to-point) for the system/equipment to be automated
050208 Verifying control system installation (e.g., PLC, DCS, PC)
050209 Versioning techniques and revision control

Task 3 Test safety elements and systems by executing test plans in order to ensure that safety functions operate as designed.

050301 Applicable safety standards, regulations, and procedures
050302 Executing and documenting test plans
050303 Safety system design

Task 4 Test security features by executing test plans in order to ensure that security functions operate as designed.

050401 Applicable security standards, regulations, and procedures
050402 Executing and documenting test plans
050403 Security system design
050404 Vulnerability assessments

Task 5 Execute operational tests in accordance with the test plan; make necessary adjustments in order to ensure the entire system, including safety and security systems, functions as designed.

050501 Adjusting final control elements
050502 Applicable standards, regulations, and procedures relative to testing
050503 Communicating final results to facility personnel
050504 Computer system performance tuning
050505 Control system hardware
Task 6 Troubleshoot and resolve problems identified during installation and testing using a structured methodology in order to correct system deficiencies and turn the system over to stakeholder.

Domain 6 Operation and Maintenance:
Prepare and implement a long-term support strategy for a project.

Task 1 Develop and conduct periodic systems and component inspection protocols to verify the operation of systems to pre-determined standards and requirements.

Task 2 Provide technical support for facility personnel by applying system expertise in order to maximize system availability.

Task 3 Work with training professionals to perform training needs analysis, establish training goals and measurable outcomes, and participate in training development and delivery for customers and personnel on the safe operation of automated systems.

Task 4 Monitor performance using software and hardware diagnostic tools in order to support early detection of potential problems.
Task 5 Perform continuous improvement by working with facility personnel in order to increase capacity, reliability and/or efficiency.