

ELECTRONIC SYSTEMS CERTIFIED DESIGNER (ESC-D) International (English)

For industry professionals with at least 3 years of experience as a residential systems designer.

This document outlines the body of knowledge on which the certification exam is built. CEDIA resources such as classes, books, and online training are designed to support this body of knowledge. Please refer to the **ESC-D Exam Prep Resources** document to find which resources support each area of study.



Domain Needs Assessment

Task 1: Initiate and investigate the scope of a project using a structured information gathering methodology to obtain customer information.

KNOWLEDGE OF:

1. Customer desires and expectations
2. Expectations for reliability and usability
3. Lifestyle and day-to-day use of the home

SKILL IN:

1. Organizing and developing the content necessary to create a formal client survey
2. Clarifying requirements
3. Interviewing/qualifying a client
4. Recording pertinent information and responses accurately
5. Determining the project stakeholders and decision maker(s)
6. Communicating efficiently and effectively

Task 2: Assess the site conditions by reviewing architectural plans and/or visiting the site in order to pre-empt architectural and structural complications.

KNOWLEDGE OF:

1. General construction methods and structural issues
2. Industry installation methods (e.g., wire types and routing)
3. Local codes and regulations

SKILL IN:

1. Working with architectural and engineering drawings
2. Taking accurate field measurements (e.g., tape measures)
3. Determining spatial relationships
4. Sketching room/existing conditions
5. Interpreting codes, regulations, and local covenants
6. Working with software based drawing/estimating programs (e.g., CAD)
7. Assessing site conditions (i.e., distance to the site, site map and directions, site parking, existing and new construction, house layout, equipment location, unusual situations, etc.)

CEDIA™ JOB TASK ANALYSIS (EXAM BLUEPRINT)

Task 3: Establish the budget requirements by setting realistic expectations of deliverables, while explaining tangible quality differences in order to deliver the optimum performance/cost balance for the systems.

KNOWLEDGE OF:

1. Estimation techniques (Bottom-Up, Top-Down)
2. Cost analysis
3. Value engineering
4. Time, cost, scope, and quality relationships
5. Installation complexities and design options
6. Life cycle costs
7. Work Package (complete package of equipment, materials, and labor for each deliverable in the system)
8. Work Package Dictionary (document that describes each component in the Work Breakdown Structure)
9. Work Breakdown Structure (deliverable oriented deconstruction of work to be executed)

SKILL IN:

1. Creating cost estimates (Bottom-Up, Top-Down, Parametric, etc.)
2. Analyzing differences in how solution options affect the design
3. Maintaining and referencing product databases
4. Applying relevant mathematical calculations
5. Identifying appropriate product(s) for each application
6. Acquiring product knowledge

Task 4: Determine internal vs. external resource requirements for the system under design for the purpose of completing cost estimation.

KNOWLEDGE OF:

1. Submittal process (RFI, RFQ, RFP, etc.)
2. Understanding terms used by associated trades
3. Trade-off analysis, including make/buy decisions, organizational limitations, and core competencies
4. Effective meeting techniques

SKILL IN:

1. Reading, interpreting, and supplying specifications
2. Setting meetings and agendas and accurately documenting the results
3. Using precise, measurable language
4. Interpreting associated trades documents
5. Defining scope of work for designated tasks
6. Communicating the design requirements effectively (written and verbally)
7. Decision making (i.e., make/buy decisions)

Domain Project Design

Task 1: Create functional specifications by translating the results of the needs assessment into activity based scenarios that can be understood by all project stakeholders.

KNOWLEDGE OF:

1. Equipment functionality and technicalities
2. Cognitive principles and ergonomics
3. Designing behaviors that support the personal goals of the users

SKILL IN:

1. Describing the sequence of product touch points
2. Creating documents that communicate sequential behaviors and interdependences (i.e., flowcharts)
3. Writing scenario narratives
4. Establishing performance levels

Task 2: Create physical specifications by translating the results of the functional specifications into system requirements.

KNOWLEDGE OF:

1. Home Theater (including surround formats, screens, masking, seating, recommended practices, performance goals)
2. Acoustics, sound isolation, and acoustical treatment options
3. Audio (components, loudspeakers, speaker sensitivity, distributed audio coverage, outdoor speakers, source options)
4. Video (formats, resolution, content protection, storage, streaming, digital imaging, broadcast formats, video conferencing, IPTV, display technologies, Blu-ray, 3D, 4K, viewing distance, viewing angle, anamorphic systems)
5. Cabling standards (CEA 2030, TIA 570-C, NEC, backbone, conduit, HDMI, fiber optics, MDU considerations)
6. Communications (telecom, VoIP, cellular, PBX, internet options)
7. Networking (specifying hardware and infrastructure, defining specifications related to QoS, segmentation, and bandwidth requirements, wireless network design, alternate carriers such as Powerline, MoCa, HPNA.
8. Interactive media spaces (gaming, performance, virtual reality, telepresence)
9. Device automation (gates, gas/electric fires, spa and pool control, irrigation, smart appliances, etc.)
10. Media servers (i.e., DVR, content management, A/V Codecs, mobile devices as sources)
11. Robotics, motorization
12. Digital rights management, metadata
13. Equipment mounting (wall/ceiling mounts, racks, thermal management)
14. Power management (i.e., power conditioning, grounding, bonding, green technology, energy management)
15. Digital home health (sensors, PERS, communication options)
16. Relevant safety regulations
17. Control systems, including user interface design, mobile devices, and communications protocols (RS232, RS422, RS485, DALI, IP, etc.)
18. Other user interfaces (i.e., ambient devices, gesture recognitions, haptics, biometrics)
19. Security and fire alarm systems, knowledge of regulations and integration of same (i.e., access control, monitoring, DVRs)
20. Lighting and shade system design and control (incl. LED)
21. HVAC system fundamentals & how to monitor/control these systems
22. Architecture and interior trim (millwork, structural, finish work, etc.)
23. Central vacuum systems
24. RF/CATV/DSS/CCTV distribution systems and HD/digital signal distribution (analog, digital, camera specs and optics, HDMI compatibility, analog sunset)
25. Basic electronics (e.g., Ohm's law, etc.)
26. Design programs and other computer applications
27. Manufacturing and product specifications
28. Technology trends & how to stay informed

CEDIA™ JOB TASK ANALYSIS (EXAM BLUEPRINT)

SKILL IN:

1. Considering future design expansions
2. Reading and interpreting product specifications, choosing products
3. Documenting system specifications
4. Identifying applicable technologies
5. Performing system related calculations
6. Calculating heat, electrical, and structural loads
7. Determining ventilation requirements (CFM, pathways, penetrations, etc.)
8. Designing and balancing audio/video distribution
9. Specifying, calculating, and analyzing acoustic design
10. Specifying spatial/mechanical/mounting/installation methods
11. Establishing performance levels
12. Determining functionality and programming requirements
13. Designing for serviceability, usability, and reliability

Task 3: Define the programming specification from the functional specification in order to determine what is to be controlled, the method and complexity of control, and the operational parameters including scripts, zone maps, and input/output relationships for the full integration of the system.

KNOWLEDGE OF:

1. Product functionality and configuration variables
2. Operational requirements, method and complexity of control
3. Structured programming, programming languages
4. Flowcharts, state diagrams, and macros
5. Interface protocols (RS232, RS485, TCP/IP, IR, digital I/O, contact closure, etc.)
6. Pseudocode and conditional logic

SKILL IN:

1. Describing sequential events
2. Specifying I/O relationships between events and actions
3. Determining fault scenarios, backup, and error recovery (i.e., reboot)
4. Reading and interpreting product manuals

Task 4: Create the user interface specification by proposing physical control arrangements in order to provide control consistent with client needs.

KNOWLEDGE OF:

1. P1. Ergonomics, aesthetics, and human factors
2. 2. User interface options and applications, including mobile apps
3. 3. Graphic design basics
4. 4. Web based control systems
5. 5. Hierarchical methods of control
6. 6. Metaphors
7. 7. Limitations of user interfaces
8. 8. Defaults and usability testing

SKILL IN:

1. Communicating ideas, concepts, and necessities
2. Choosing the appropriate physical control device
3. Evaluating the user interface designs through usability testing

CEDIA™ JOB TASK ANALYSIS (EXAM BLUEPRINT)

Task 5: Direct the creation and evaluation of prototypes and/or working mock-ups to ensure design requirements.

KNOWLEDGE OF:

1. Equipment space and load bearing requirements
2. Equipment power, ventilation, and control requirements
3. Function and limitations of the prototype and/or mock-ups
4. Client approval of UI mock-ups (touchpanel, keypad, mobile)

SKILL IN:

1. Sketching design ideas
2. Understanding and using test equipment
3. Documenting the test outcome and/or sample evaluation and obtaining signoff
4. Researching changes in codes, regulations, and standards
5. Testing the validity of new technologies in the design

Domain **3** Design Documentation

Task 1: Create a proposal (bill of material, resource list, and labor products) based on the cost estimate by generating appropriate documentation in order to communicate the requirements of the project.

KNOWLEDGE OF:

1. General knowledge of all trades, sub-contractors, and other design professionals and their responsibilities
2. Relevant product knowledge, incl. interconnection and interaction
3. Subsystem knowledge, incl. interconnection and interaction

SKILL IN:

1. Generating details related to equipment, parts, and materials
2. Describing assemblies and sub-assemblies

Task 2: Generate electronic system plans for distribution to relevant parties by preparing or modifying architectural plans in order to determine the location of devices and wire routes, including installation and construction notes.

KNOWLEDGE OF:

1. Accepted building codes (local, national)
2. Drawing legends, icon definition, and usage (ANSI-J-STD-710)
3. Fundamental ergonomics (Dreyfuss Human Factors, etc.)
4. Product placement criteria
5. Serviceability and usability
6. Drawing layers
7. Installation guidelines and criteria
8. Document revision control
9. Interior design (aesthetic considerations, furniture layout)
10. Site considerations and traffic patterns

SKILL IN:

1. Reading and annotating drawings
2. Interpreting installation guidelines and criteria
3. Creating plan drawings
4. Product placement (i.e., user interfaces, components, equipment mounting, speaker layout, etc.)

CEDIA™ JOB TASK ANALYSIS (EXAM BLUEPRINT)

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2. Drawing legends, icon definition, and usage (CEA/CEDIA/InfoComm J-710)
3. Fundamental ergonomics (Dreyfuss Human Factors, etc.)
4. Product placement criteria
5. Serviceability and usability
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7. Installation guidelines and criteria
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9. Interior design (aesthetic considerations, furniture layout)
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SKILL IN:

1. Reading and annotating drawings
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3. Creating plan drawings
4. Product placement (i.e., user interfaces, components, equipment mounting, speaker layout, etc.)

Task 3: Generate block diagram (single-line drawing) by showing basic system level interconnection between components and sub-systems in order to troubleshoot and illustrate signal flow and functionality.

KNOWLEDGE OF:

1. Concepts of signal flow and control nomenclature
2. Flow charts in order to create block diagrams
3. Components used in system
4. Cables and terminations

SKILL IN:

1. Generating block diagrams
2. Appropriate drawing/drafting skills
3. Organizing layout and annotating for clarity of presentation

Task 4: Create cable documentation (i.e., cabling plan and schedule) by describing the origin, destination, and type of each wire along with associated devices for distribution to associated trades.

KNOWLEDGE OF:

1. Cable types, outlets/inlets, connectors, back boxes
2. Connection of all sub-systems
3. Signal types
4. Cable characteristics
5. Trades involved
6. Local codes, regulations, and standards
7. Wire management practices

SKILL IN:

1. Using electrical formulas to calculate wire specifications
2. Specifying appropriate cable types (i.e., fire ratings, class, shielding, etc.)
3. Specifying connectors and connectorization

CEDIA™ JOB TASK ANALYSIS (EXAM BLUEPRINT)

Task 5: Generate point-to-point wiring diagram by describing the specific input-output, wire and connector types, and method of interconnection in order to document how the components will be connected.

KNOWLEDGE OF:

1. Concepts of signal flow and control nomenclature
2. Components used in system
3. Cables, connectors, pinouts, terminations, and color codes
4. Back-panel layout of all devices in the system
5. Basic point-to-point information including symbols, grounding, voltage requirements, and other safety related information

SKILL IN:

1. Generating point-to-point drawings
2. Referencing point-to-point to cable schedule
3. Applying electrical and safety codes
4. Organizing layout and annotating for clarity of presentation
5. Detailing cable connector, pinouts, terminations, and color code requirements
6. Defining drawing layers (e.g., audio, video, control, RF, power, etc)

Task 6: Compile and re-generate as-built drawings and Operations/ Maintenance manuals by updating all post-installation construction documents.

KNOWLEDGE OF:

1. Red-lining techniques
2. Change orders
3. Project history

SKILL IN:

1. Creating and managing archive files
2. Reading construction documents
3. Version control
4. Recording setup parameters

Task 7: Prepare test specifications to verify system performance and functionality.

KNOWLEDGE OF:

1. Functions and limitations of test equipment
2. Process of evaluating entire system
3. Thorough understanding of the finished project
4. Setup parameters and performance specifications

SKILL IN:

1. Verifying that the design requirements were satisfied
2. Creating a quality control and assurance checklist
3. Making qualitative assessments and inspections
4. Preparing test reports
5. Interpreting the results of the tests

Domain Design Management

Task 1: Assess the impact of change orders on the overall design.

KNOWLEDGE OF:

1. Technical limitations of all associated equipment within the system
2. Comprehensive understanding of original design intent
3. Impact of industry factors (i.e., new technologies, back orders, codes and standards, etc.)
4. Impact of organizational factors (i.e., internal vs. external resources, etc.)
5. Impact of customer factors (i.e., color preference, budget)

SKILL IN:

1. Recalculating budget costs
2. Analyzing how different solution options affect the design
3. Consulting with clients, installers, and other design professionals
4. Recalculating resource requirements for impacted work packages

Task 2: Monitor and document progress of the project to ensure design compliance.

KNOWLEDGE OF:

1. Assigned responsibilities of the contractors and sub-contractors
2. Existence of key project milestones
3. Communication plan
4. Original design intentions

SKILL IN:

1. Documenting progress
2. Inspecting installation progress by conducting periodic site visits
3. Initiating periodic status reports
4. Maintaining communication log
5. Generating, reviewing, and approving submittals