CFSE GOVERNANCE BOARD

Exam Results Detail Document

Candidate Name: Mr. Josef Safety
Exam Type: Process Application
Exam Date: January 1, 2001
Exam Location: Munich, Germany

Scope of Exam: The Process Applications program applies to personnel involved in the implementation of safety-related systems in Process Applications. The curriculum for this program consists of general knowledge plus the knowledge in the applicable field of expertise:

1. General requirements of IEC61508 and IEC61511
    a. The Safety Lifecycle
    b. Safety Requirements Specifications
    c. SIL Selection
    d. Conceptual Design
    e. SIF Verification
    f. Operations and Maintenance
2. Other relevant national and international standards (US EPA RMP, US OSHA PSM, ISA 84.01)
3. Common terms and definitions
    a. Safety, availability and reliability relationships
    b. Systematic vs. Random failures
4. Safety Lifecycle concepts and objectives
5. Requirements for Management of Functional Safety
6. General documentation requirements
    a. Change control requirements
    b. Approval requirements, independence of approval
7. Hazard identification, analysis and risk assessment concepts and procedures
    a. ALARP and tolerable risk
    b. Identifying safety functions
8. Consequence analysis concepts
9. Likelihood analysis concepts
10. SIL selection concepts and procedures
    a. Layer of Protection Analysis
    b. LOPA Independence

11. Safety Requirements Specification requirements
12. Typical failure modes of equipment used in SIS
13. Wearout mechanisms of equipment used in SIS
14. SIL verification concepts and procedures
    a. Understanding of different calculation methods and limitations
    b. Understanding of failure rate data and limitations
    c. Understanding of periodic test procedures and effectiveness
15. General design concepts and procedures
16. Detailed design concepts and procedures
17. Installation requirements
18. Safety validation concepts and procedures
19. Management of change concepts and procedures
20. De-commissioning concepts and procedures

Actual Exam Results:

Multiple Choice – Total Score 35/50
Case Studies – 25/50
Total Score – 60/100, Minimum score is 80

Multiple Choice Results

Answers to be read as follows:
Topic of Question – Correct or error

1. High demand/low demand – correct
2. Risk – correct
3. Safety Requirements Specification (SRS) – error
4. Diagnostic coverage – error
5. Fault tolerance – correct
6. Systematic faults – error
7. Systematic faults – error
8. Fault tolerance – correct
9. Safety integrity vs. availability – error
10. PFD – correct
11. Safety lifecycle – correct
12. V&V – error
13. LOPA – error
14. LOPA – correct
15. LOPA – error
16. Security – error

17. FMEA – correct
18. PFDavg calculation – correct
19. Useful life – error
20. Calibration – error
21. 61511 – correct
22. SRS – correct
23. Validation – error
24. Consequence – correct
25. HAZOP – correct
26. Trip point – correct
27. SRS – correct
28. Logic – correct
29. Logic – correct
30. Markov – correct
31. Common cause – correct
32. SIL – correct
33. PFD – error
34. Logic – correct
35. Safety lifecycle – correct
36. 61511 – correct
37. 61508 certification – correct
38. Logic – correct
39. SIL – correct
40. Fault tolerance, architectures – error
41. Useful life – correct
42. Systematic failure – error
43. Logic – correct
44. Failure rate – error
45. Useful life – correct
46. SFF – error
47. Common cause – correct
48. Safety vs. availability – error
49. Safety vs. availability – correct
50. Likelihood – error

Case Study. (Candidate answered all questions, 80 points, even though exam had bold, red instructions to answer only 50 points worth. Therefore results were scaled to 50 points).

Short Answer Section

Answers to be read as follows:
Topic of Question – points received/points possible

1. 61511 definition – 0/2
2. Risk analysis – 2/2
3. V&V – 2/2
4. Architectures – 1/4
5. Architectures – 2/2
6. PFDavg – 1/2
7. 61508 – 2/2
8. 61508 – 2/2
9. SFF – 1/ 2
10. 61508 software – 0/2
11. SFF – 2/2
12. 61511 definition – 1/ 2
13. Assessment – 2/2
14. SIF – 1/ 2
15. Risk analysis – 2/2

Case Study Section

1. PFDavg – 1/4
2. PFDavg – 0/4
3. FMEA – 10/20
4. Conceptual design – 7/8
5. Assessment – 3/4
6. Conceptual design – 2/4
7. Common cause – 2/4

Critique:

1. Exam strategy – the candidate should carefully read all instructions before proceeding with any exam section. In part 2, time taken to complete all questions would have been better spent reviewing and refining answers to selected questions worth only 50 points. The candidate answered all 80 points and some of these questions were not answered well. They should have been skipped. It is estimated that a better strategy would have improved the score by 12 points.

2. Knowledge areas –
    a. 61511 definitions – these should be reviewed directly from the standard. A thorough knowledge of these definitions would have improved the score by an estimated 4 points.
    b. PFD/PFDavg – the reliability engineering concepts behind PFD and PFDavg calculations should be studied and understood. References on the formulas and their derivations would also help. Complete knowledge of this topic would have improved the score by an estimated 10 points.
    c. Fault tolerant architectures – a deeper understanding of the tradeoffs in fault tolerant architectures would have resulted in an estimated score improvement of 4 points.
    d. Common cause – a better understanding of common cause and common cause modeling would have improved the score by an estimated 3 points.
    e. Basic Reliability Engineering – a deeper understanding of failure rates, wearout mechanisms and the bathtub curve would have improved the score by an estimated 3 points.
    f. Systematic vs. Random failures – a deeper understanding of failure types and the characteristics of systematic failures versus random failures would have improved the score by an estimated 3 points.
    g. LOPA – a better understanding of LOPA techniques and limitations would have improved the score by an estimated 3 points.
    h. SFF / Architectural Constraints – a better understanding of diagnostic coverage, safe failure fraction and the architectural constraints charts of 61508/61511 would have improved the score by an estimated 2 points.
    i. IEC 61508 certification – a better understanding of the benefits and limitations of IEC 61508 certification of products would have improved the score by an estimated 1 point.