BE Instrumentation sem VII (CBSGS) 14/12/18 (1/2)

(3 Hours)

Total Marks: 80

N.B. 1. Question No.01 is **compulsory**

  2. Attempt any **Three** questions from remaining **Five** questions

  3. Assume suitable data wherever required

1.   Answer the following (Any Four)   20

  a.   Compare basic process control system and SIS.
  b.   What is safety life cycle? Discuss the need of SLC.
  c.   What do you understand by mutually exclusive and non- mutually exclusive event? Explain.
  d.   An explosion in the process area of a plant does not affect any normally occupied buildings. The personnel density is 0.002 per square meter and the capital density is 150000 per square meter. The explosion has fatality effect zone of $5600m^2$ and equipment damage effect zone of $2400\ m^2$. The vulnerability of both personnel and capital in these effect zones is 100 percent. What is the consequence of this explosion in terms of probable loss of life (PLL) and estimated value (EV).
  e.   What is low demand mode and high demand mode operation for SIL selection? Explain.

2. a.   Draw and explain safety life cycle for IEC 61508.   10

  b.   A hazard assessment team considers two recommended safety instrumented functions (SIFs). They have performed quantitative analysis of the risk, yielding a consequence of PLL= 0.21 for the first event and a consequence of PLL= 2.5 for the second event. A LOPA yielded likelihood of 1/576 events per year for both events. The facility for which this SIF is being considered has a maximum individual risk of fatality criterion of 2.0×10^{-5} and uses 'risk-averse' societal risk criteria where the risk aversion factor is 2. Using an SIL- only assignment, an SIL-plus-RRF assignment, and a 'fractional' SIL assignment, Select the most appropriate safety integrity level specification for this situation.   10

3. a.   Discuss in detail risk matrix method for SIL determination.   10
  b.   Discuss in detail prevention layers.   10

4. a.   Explain in detail fault propagation modelling for likelihood analysis.   10
  b.   What is safety instrumented function? Explain in detail using any examples.   10

5. a. Write advantages and disadvantages of relay system and solid state device system.   10
  b. What are the methods uses for consequence analysis? Explain in detail.   10

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6. a. Consider a system composed of a transmitter, controller, and valve.   10
       The probability of failure, over the next five-year period, for each of the components
       is as follows:-

   $P_{f,transmitter} = 0.15$ $P_{f,controller} = 0.008$, $P_{f,valve} = 0.19$

   Over the next five-year interval, what is the probability of success of this system?

   (Use AND and OR logics ,and compare the solution)

   b. Explain in detail the SIL determination using risk graph method.   10

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