Certification Level III – Expert in Grounding, EMI, Lightning Shielding &, Transients

Candidates must acquire the following skills in order to be certified.

Level III Certification: Expert in Grounding, EMI, Lightning Shielding & Transients

The Expert Certification training provides Level II graduates that have not completed both Level II specialization focuses (i.e., substation grounding or power line EMI), the ability to refocus on the missing specialization and carry out transient studies involving power system effects on low voltage circuits and design corrective measures. This Level III Certification is intended to insure mastery of use of the CDEGS software package to solve complex engineering problems. Level III graduates are recognized by SES as expert consultants in the areas of power system grounding, EMI, lightning and other transients. They are expert users of the CDEGS software package.

Prerequisites:

- Practical Experience: At least three years of work experience in electrical engineering; alternatively, a degree in electrical engineering or physics and two years or more of work experience in electrical engineering. The candidate must also demonstrate proficiency in the Level II specialization previously chosen.
- Level II Certification

Period of Validity:

Four years. After this period, the candidate must attend an updated course and pass the associated exam.

Course Description:

This course consists of the complement (if applicable) to the Level II specialization previously chosen by the candidate, as described in the Level II curriculum, as well as the following subjects:

- Calculation of the self and mutual impedances of arbitrary 3D circuits made of conductor and complex cable systems.
- Determination of interference (EMI) caused by complex energized systems on exposed low voltage circuits during normal, fault and transient conditions such as magnetic fields from reactors and back-to-back switching of capacitor banks.
- Design of efficient shielding systems.
- Study of transient performance of electric installations subjected to lightning or surge currents.
- Design of mitigation measures aimed at suppressing or reducing EMI levels.

Upon successful completion of the Expert Certification course, candidates will therefore have a well-rounded education and expertise in the areas of high voltage substation grounding, AC interference from high voltage lines and large magnitude transient interference with low voltage circuits. The participant will be able to perform complex technical tasks independently and advise others on the performance of these tasks, as well as be able to evaluate, synthesize and communicate abstract concepts and make judgments about information and validity of ideas.

Candidates for the Expert certification level must complete and pass an exam at the training session to verify their mastery of the material taught at the course. They must also be able to demonstrate their experience and proficiency in their Level II area of specialization (e.g., attendance at SES Users Group Conferences, technical reports, publications, etc.).

1. Calculation of the self and mutual impedances of arbitrary 3D circuits

2. Interference Issues During Normal Conditions

- Build a set of three-phase 345 kV reactors.
- Determine the best way to connect the reactors to the power sources in order to reflect accurately the magnetic effects of the reactors.
- Determine the appropriate mitigation methods required to avoid excessive induced currents in conductors and structures.

3. Examine Back-Back Switching of Capacitors Banks

- Specify all required information and data that must be collected from all stake holders in order to be able to build realistic and accurate computer models of a back-to-back switching event.
- Build accurate models of the substation including the capacitance banks.
- Build appropriate substation structure configurations.
- Model control cables from the capacitor bank area to the control room.
- Select appropriate cable sheath grounding models of the control cable and examine various grounding schemes including shielding and parallel neutral wires in the cable trench.

4. Establish Effectiveness of Shielding System on Substation

- SES Substation consists of six 300 kV overhead lines, two banks of 3 three-phase Y-Y delta grounded 300-150 kV autotransformers, four 150 kV overhead lines, and one 15 kV power transformer, and several 15 kV distribution circuits. Add lightning masts as necessary to insure that lightning is intercepted at all exposed locations using the standard Rolling Sphere method.
- Carry out similar analysis using all other applicable methods. If the designed shielding system fails for any of the other methods, determine what is needed in order to make sure that lightning is intercepted for all other methods.

5. Examine Safety and Equipment Integrity Issues During Transient Situations

- Describe the various methods that can be used to determine the safety status during back-to-back switching and lightning surges in order to validate the final design.
- On SES Substation, examine what would happen to the protection and control system in the event of a lightning strike.
- Model the shielded and un-shielded control cable scenarios.
- Establish adequate mitigation measures to reduce stress voltages on control cables and associated equipment.

6. Conclusions

- Describe briefly the most salient findings and knowledge that you have acquired during this training that you were not aware of before.