



Grounding, EMI and Lightning Academy Training & Certification Programs



**Developing Expertise.
Certifying Experts.**

Training & Certification for Grounding, EMI and Lightning Analysis

Safe Engineering Services & technologies Ltd. (SES) provides flexible technical education services, ranging from a basic to an expert level, to enhance the knowledge and skills of professionals who conduct analyses and design work in the areas of grounding (earthing), electromagnetic interference (EMI), lightning and transient analysis.

Certification Path - Overview

A certification from SES is an attestation of an individual's competence and knowledge in the areas of grounding, EMI, and transient analysis, as well as in the use of the CDEGS software package. There are three levels of certification:

SES Certification Levels



Level 1 Certification implies an understanding of fundamental concepts, and an ability to evaluate work performed by others. Level 2 Certification indicates an ability to conduct advanced analyses and to use CDEGS to complete studies and designs in one of two specialties. Individuals with a Level 3 Certification have demonstrated expertise in the analysis of all complex aspects of grounding, EMI and lightning analyses, and when required can design efficient and economical mitigation measures.

Getting Certified

SES understands the challenge of balancing work responsibilities with training needs. With this in mind, the SES Grounding, EMI and Lightning Academy offers a variety of courses, in different formats, which can be attended in various locations including: your facility, the SES training center, or at periodically announced venues located in major cities across the world.

Training Formats

Standard Training (Level 1 Certification - Fundamental)

The majority of individuals interested in obtaining training from SES—including those seeking certification—typically begin with a Standard Training Course, also referred to as a seminar. This course covers key concepts for conducting studies involving power system grounding, electromagnetic interference, lightning and other transients, and includes practical design concepts that are reinforced with hands-on computer simulations. Participants also learn about the field techniques that are required to ensure that soil resistivity, grounding grid impedance, and related safety criteria and parameters are accurately measured. Candidates who master the topics covered in a Standard Training Course are

prepared to pass the Level 1 Certification exam, which all attendees may elect to take at the conclusion of the course.

Level 2 (Advanced) and Level 3 (Expert) - Certification Training

Candidates with a valid Level 1 Certification are eligible to pursue Level 2 (Advanced) certification which, once attained, can lead to Level 3 (Expert) Certification.

Our Level 2 and 3 Certification Training Courses follow a well-defined program designed to enable a systematic accumulation of the knowledge and skills required to pass the certification exam. In some cases, the course content may include details from a course participant's real world project which—in terms of coupling training with project advancement—enables a maximum realization of benefits for the participant.

For the Level 2 and Level 3 Certification Training Courses, there is a maximum of ten students per class, ensuring ample individual attention for every participant.

Details about each certification level—including course descriptions and prerequisites—are provided in a [separate section](#) of this document.

Customized Training

The location, schedule, and content of our Customized Training Courses are determined by the client.

It is common for a Customized Training Course to cover details related to a client's project. If the client wishes to pursue certification, the instructors will ensure the course includes material of a breadth and level of detail commensurate with the target certification level.

Locations

International

SES periodically announces standard training courses (seminars) and other certification training courses in the Montreal area and, periodically, in other major cities throughout the world.

Dates and locations can be found on our [Training Registration](#) page.

Customer Facility

SES instructors will also travel to a client's location to provide training that is customized to the client's schedule and objectives.

SES Training Center

The SES Training Center in Laval, Canada, is a first-rate teaching facility, offering onsite accommodations for attendees who wish to forgo the commute from a hotel, while also taking advantage of our comfortable lodging facilities. Fixed dates for certification training are announced on SES's [website](#). The SES Training Center is also available for customized training.



Online Web Conferences

Organizations opting for one of our online webinars will be able to determine the content, number of attendees, and schedule of their training sessions. The cost is based on an agreed fixed amount per event, regardless of the number of attendees.



How to Proceed

Identify the Target Certification Level & Determine Eligibility

The first step in becoming certified is to determine the certification level exam for which you are eligible.

For most¹, the first step toward certification is to attend an SES Standard Training Course—commonly referred to as a seminar—and to complete the included Level 1 Certification Exam at its conclusion. Successful candidates are eligible to enroll in a Level 2 Certification Course.

¹ For certain individuals—including those who were previously certified but whose certification has lapsed, or those who previously attended a Standard Training Course—it may be possible to (re)take the Level 1 Certification Exam without having to complete a Standard Training Course. Inquiries regarding our Compressed Certification option, which is available for qualified individuals and for Level 1 Certification only, may be sent to our [Sales](#) team. Please see our [website](#) for additional information including eligibility criteria.

Similarly, Level 2 Certification is a prerequisite for attending a Level 3 Certification course.

Select the Venue & Attend the Training

Select the venue, register and attend the entire training session.

Please refer to our [Certification Training Courses](#) page for an overview of dates and locations of upcoming training. Additional details about venues can be found on our [Venues](#) page.

Complete the Certification Exam

Students who pass the minimum achievement level for the certification exam will be granted the certification corresponding to the target certification level.

Obtain the Certificate

Successful candidates receive copies of their certificates via mail, and their names will be posted on SES's [website](#) for the validity period of the certification.

Maintain the Certification

A Level 1 Certification (Fundamental) is valid for a period of ten years from the date of issue. Individuals needing to extend the validity period of a Level 1 Certification must complete another Standard Training Course, or a [Refresher Course](#), and pass the associated exam.

To extend the validity of a Level 2 (Advanced) or Level 3 (Expert) Certification, which are valid for a period of six and five years respectively, individuals must attend an updated Certification Training Course and then pass the associated exam.

Certification Courses - Details

Level 1 Certification: Fundamental

The Fundamental Certification training is designed for participants with little or no familiarity with grounding, lightning and EMI issues. Attaining a Level 1 Certification indicates that an individual understands the key concepts related to grounding, lightning and EMI studies, and is therefore in a position to evaluate the validity of such studies as a manager, supervisor or client.

Duration: 4.5 Days

Certification Program Prerequisites:

- **Practical Experience:** At least one year of work experience in electrical engineering or a degree in electrical engineering or physics
- **Knowledge:** Good understanding of basic circuit theory and fundamental knowledge of electromagnetism (Ampere's and Faraday's laws, etc.)

Period of Validity: 10 years. To extend the validity of a Level 1 Certification, the candidate must attend a Refresher Course and pass the associated exam.

Course Description:

During Part I of the course, the three modes of electromagnetic energization are introduced. Earth resistivity measurement and interpretation techniques are discussed, for uniform, multilayered earth and other complex soil models. The concepts of soil model equivalence and soil layer resolution is explained, based on computer simulations. The analysis and design of simple and complex grounding systems comprised of arbitrarily oriented three-dimensional conductors buried in multilayered soils are discussed and illustrated with practical examples. The case of grounding systems partially buried in a finite volume (e.g., backfill) of heterogeneous soil is explored. The scientific concept of earth impedance measurements using the Fall-of-Potential method is explained clearly based on various realistic soil models. Transmission line, buried cable and buried pipeline parameters (self and mutual impedances) in layered earth are analyzed and fault current distribution computation techniques are described. Electrical safety concepts are introduced and issues involving body currents, body impedances and foot resistances are discussed for power frequency and high frequency electric exposure.

In Part II of the course, conductive and inductive interference effects caused by energized conductors on overhead and buried bare or coated metallic structures and conductors, such as pipelines, fences and communication wires are introduced and investigated in detail. Mitigation methods and equipment are presented and their relative merits are discussed. Interaction between the sources of the interference and the exposed lines or circuits is examined in detail. Finally, electric and magnetic fields generated by energized overhead and buried conductors at low and high frequencies as well as during transient conditions, such as lightning strikes, are described and typical analysis methods and computation results are explained. Candidates seeking Level 1 Certification must complete and pass an exam at the end of the training session.

Upon completion of the Level 1 course, candidates will be able to:

- Understand the fundamentals of grounding and EMI as related to electric systems
- Explain and eliminate many misconceptions, ambiguities and incorrect measurement, analysis and design techniques, which still abound in the industry and are taught at some courses
- Comprehend scientific concepts using practical examples drawn from the course material and provided documents
- Recommend appropriate soil resistivity test measurements as well as Fall-of-Potential, touch and step voltage field measurements
- Supervise and assist technicians to carry out accurate measurements using appropriate equipment
- Understand differences between various soil structure models
- Discuss and describe the various types of grounding system configurations
- Evaluate electrical safety concerns and be able to identify unsafe conditions
- Comprehend the fundamental methods used in the steady state and fault analyses of electric circuits
- Apply all project management steps required to complete analyses and designs of electrically small and large grounding systems
- Understand the mechanisms of ac interference (EMI) and the methods used to mitigate their deleterious effects
- Understand the basic concepts of lightning shielding methods and techniques
- Understand the basics of insulation coordination and surge arrester applications that provide overvoltage protection from events such as switching and lightning surges
- Understand the fundamental differences between fault and high frequency transient (lightning) effects on electric systems

Level 2 Certification: Advanced (Substation Grounding or EMI Specialization)

The Level 2 training is designed for those with a Level 1 Certification who wish to learn to perform studies themselves and carry out design work in one of two areas of specialization: substation grounding (including lightning shielding) or power line electromagnetic interference. Individuals with a Level 2 Certification are recognized by SES as having the ability to carry out such studies using the CDEGS software package, without supervision, and to evaluate the work of others.

Duration: 4.5 Days

Certification Program Prerequisites:

- **Practical Experience:** At least two years of work experience in electrical engineering; alternatively, a degree in electrical engineering or physics and one or more years of work experience in electrical engineering
- **Level 1 Certification**

Period of Validity: 6 years. To extend the validity of a Level 2 Certification, the candidate must attend an updated certification course, and pass the associated exam.

Course Description:

There are two Advanced (Level 2) Certification specializations:

- Grounding Performance of High Voltage Substations
- Interference from High Voltage Lines (EMI)

Regardless of which specialization is selected for the Level 2 Certification, the next certification level, Level 3 (Expert), will be focused on topics related to the specialization that was not selected for the Level 2 Certification. The Expert Level certification therefore attests to expertise in both subject areas.

Candidates must complete and pass an exam to verify their mastery of the material and submit proof of the required industry experience. This can include attendance at SES Users' Group Conferences, technical publications, etc.

1. Upon completion of the Advanced Certification course with a specialty in **Grounding Performance of High Voltage Substations**, the candidate will be able to:
 - Specify all required field measurements required for the completion of a study, including specification of appropriate equipment and test procedures
 - Accurately interpret and refine soil resistivity measurements as well as Fall-of-Potential, touch and step voltage measurements
 - Determine the appropriate soil structure models and their limiting cases due to seasonal and geographical variations
 - Construct realistic soil models of complex environments using finite volume models
 - Build accurate models of electric substations located in rural, semi-urban and urban areas and carry out the required fault current distribution analysis and complete the design of their grounding systems with all necessary mitigation measures
 - Model power cables including pipe-type cables, gas insulated substations (GIS) and gas insulated lines (GIL), as applicable

- Include in the computer model various transformer types such as three-phase, three-winding, auto and HVDC special type transformers, for accurate modeling of circulating currents during fault conditions in a substation or outside the substation
 - Evaluate electrical safety concerns and be able to identify unsafe conditions
 - Apply appropriate insulation coordination that provides overvoltage protection for communication circuits entering a site
 - Apply various efficient and economical mitigation techniques to ensure the safe performance of the grounding design
2. Upon completion of the Advanced Certification course with a specialty in **Interference from High Voltage Lines (EMI)**, the candidate will be able to:
- Specify all soil resistivity measurements required along a joint-use corridor to be studied for ac interference effects, including specification of appropriate equipment and test procedures
 - Accurately interpret and refine soil resistivity measurements
 - Determine the appropriate soil structure models and their limiting cases due to seasonal and geographical variations
 - Build accurate models of transmission and distribution lines entering electric substations located in rural, semi-urban and urban areas
 - Select appropriate tower structure configurations and ground impedances along the lines
 - Model power cables including pipe-type cables and gas insulated lines (GIL), as applicable
 - Select appropriate models of gas and oil pipes, water pipes, railway tracks and communication lines, as applicable
 - Understand the fundamental concerns of gas and oil pipeline companies, railway companies and communication line companies in order to address all important issues adequately
 - Evaluate electrical safety concerns and be able to identify unsafe conditions specific to each utility or industry
 - Understand the various mitigation techniques that are applicable to a specific utility and provide efficient and economical mitigation techniques to ensure the safe performance of the affected utility
 - Carry out a comprehensive analysis of the performance of the entire joint-use corridor during steady-state and fault conditions

Level 3 Certification: Expert

The Expert Certification training provides those with a Level 2 Certification with the complementary Level 2 specialization (substation grounding or power line EMI), the ability to carry out transient studies involving power system effects on low voltage circuits and to design corrective measures and, generally, mastery of the use of the CDEGS software package to solve complex engineering problems. Individuals with a Level 3 Certification are recognized by SES as expert consultants in the areas of power system grounding, EMI, lightning and other transients, and as power users of the CDEGS software package.

Duration: 4.5 Days

Certification Program 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 2 specialization previously chosen.

➤ Level 2 Certification

Period of Validity: 5 years. To extend the validity of a Level 3 Certification, the candidate must attend a Refresher Course and pass the associated exam.

Course Description:

This course consists of the complement to the Level 2 specialization previously chosen by the candidate, as described in the Level 2 curriculum above, as well as the following subjects:

- Calculation of the self and mutual impedances of arbitrary 3D circuits made of conductors and complex cable systems
- Determination of interference (EMI) caused by complex energized systems on exposed low voltage circuits during fault and transient conditions
- Carrying out comprehensive lightning shielding designs of substations and industrial plants
- Studies of transient performance of electric installations subjected to lightning or surge currents
- Designing efficient and economical mitigation measures aimed at suppressing or reducing EMI levels

Upon successful completion of the Expert Certification course, candidates will 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 should 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 to make judgments about information and validity of ideas.

Candidates for Level 3 (Expert) Certification must complete and pass an exam 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 2 area of specialization (e.g., attendance at SES Users Group Conferences, technical publications, etc.).

Additional Details

Instructors

The SES Grounding, EMI, and Lightning Academy is led by SES's leading experts who each have over 10 years of theoretical and practical experience. They use the latest teaching methods to facilitate knowledge acquisition and maximize retention of the acquired knowledge and skills.

Balance between Theory and Practice

Indispensable theoretical concepts are constantly supplemented by practical exercises, based on real case studies, in order to achieve maximum proficiency in the topic that is the focus of each course segment.

Course Materials

SES's course materials are based on high-quality and comprehensive documents and computer files, to ensure that once the training is complete, the student has all the gathered information and documentation readily available, on appropriate computer storage media.