TRAINING 2021

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E&S Grounding Solutions
LIVE WEBINAR TRAINING
Grounding and Earthing

E&S VILT *(Virtual Instructor-Led Training) simulates the classroom experience in a virtual environment, providing Students/Attendees the combined benefits of online convenience, with real-time access to senior-level instructors offering both IEEE CEU and PDH certification.*

E&S on-line seminars offer students a well-rounded understanding of all the electrical engineering issues they may come across in their diverse duties.

training@esgrounding.com

703 Pier Avenue, Suite B174, Hermosa Beach, California 90254, USA

15 COURSES & 25 MODULES to choose from

Detailed module descriptions are included towards the end of this document.

Register on-line at training.esgrounding.com or call us direct at: 310.318.7151

COURSE TITLE	# MODULES	LENGTH	DELIVERY	PRICE / SEAT

COURSE # 98

Grounding & Earthing Concepts (Extended) - Webinar	2	2 hours	1 day	**$129**

The course provides an introduction to critical grounding and earthing core concepts, and the driving Engineering Principles associated with these concepts. Also includes: the purpose of grounding and earthing, the electrical systems that comprise an electrical grounding/earthing system, the sphere-of-influence theory, basic information about electrodes, the types of testing related to grounding and earthing, and the basic components that make up grounding and earthing networks.

#1	Webinar

COURSE # 99

Grounding & Earthing Concepts Webinar	1	1 hour	1 day	**$95**

This one-hour course provides an introduction to several grounding and earthing core concepts, including: the purpose of grounding and earthing, the electrical systems that comprise an electrical grounding/earthing system, the sphere-of-influence theory, basic information about electrodes, and basic information about the types of testing related to grounding and earthing. This course is delivered in a single 1-hour session.

#1	Webinar

COURSE # 100 M

Grounding & Earthing for Managers	1	2 hours	1 day	**$179**

This two-hour course is designed to educate the manager about the legal risks and responsibilities related to their primary electrical safety system for personnel: the grounding, earthing, and bonding systems at their facilities. Cost-of-life analysis, regulatory responsibilities, testing protocols, test equipment, and the fundamentals of electrical faults will be discussed. This course is delivered in a single 2-hour session.

#2	Grounding & Earthing System for Managers

COURSE TITLE	# MODULES	LENGTH	DELIVERY	PRICE / SEAT

COURSE # 101

Introduction to Grounding & Earthing	2	4 hours	1 day	$259

This four-hour course is designed to educate the student on why grounding and earthing is important and to make them aware of the full scope of electrical phenomena or "factors" related to the grounded or earthed conductor system. The course will discuss the purpose of grounding and the engineering factors associated with grounded systems. This course is not designed to educate the student on regulatory issues. This course is delivered in a single day, across two 2-hour sessions.

- #3 Electrical Basics & Purpose of Grounding
- #4 Engineering Factors

COURSE # 102

Applications of Grounding & Earthing *(101 Required)*	2	4 hours	1 day	$259

This four-hour course is designed to educate the student on the basics of grounding and earthing electrodes as related to the National Electrical Code (NEC). The course will also discuss how to conduct 2-point continuity and 3-point resistance-to-ground testing. This course is a supplement to the 101 course, and is part of the "One-Hundred Series" designed to provide a comprehensive understanding of grounding, once all five (5) parts have been completed. This course is delivered in a single day, across two 2-hour sessions.

- #5 Introduction to Electrodes & Ground Faults
- #6 Testing of Ground Systems (How to do the tests)

COURSE # 103

Lightning Protection Systems *(101 Required)*	2	4 Hours	1 day	$259

This four-hour course is designed to educate the student on lightning strikes, lightning protection systems (LPS), the standards and regulations governing lightning protection, lightning risk assessments (LRA), and the basics of lightning protection system installations. The course is not intended to be an installation guide, but a general educational course on how lightning protection systems work and what the key areas or protection are needed. Supplement to the 101 course and is designed to provide a comprehensive understanding of grounding, once all 5 parts have been completed. This course is delivered in a 1 day, across two 2-hour sessions.

- #7 Lightning Protection Systems
- #8 Advanced Lighting Protection Systems

COURSE # 104

Grounding & Earthing for Cell Sites, Data Centers, and Motorola R56 *(101 Required)*	2	4 Hours	1 day	$259

This course is designed to educate the student on the grounding and earthing requirements for cell sites, data centers, server rooms, laboratories, and other electronics-heavy systems. This course will cover real-world applications of testing methods, and discuss the requirements found in Motorola's R56 Standard, AT&T's Standard ATT-TP-76416, and the ANSI/TIA-STD-607-D. Supplement to the 101 course and is part of the "One-Hundred Series" designed to provide a comprehensive understanding of grounding, once all 5 parts have been completed. This course is delivered in a single day, across two 2-hour sessions.

- #9 Commissioning and Maintenance (App of the Tests)
- #10 Telecom Standards

COURSE # 105

Grounding & Earthing for Electronics, Instrumentation, and Isolated Grounds *(101 Required)*	2	4 hours	1 day	$259

This four-hour course is designed to educate the student on the complexities of fault currents, isolated grounds and special grounding systems for electronics and instrumentation. The course will cover real-world walk-throughs of faults scenarios and neutral-to-ground bonds. This course is a supplement to the 101 course and is part of the "One-Hundred Series" designed to provide a comprehensive understanding of grounding, once all five (5) parts have been completed by the student. This course is delivered in a single day, across two 2-hour sessions.

- #11 Normal Operating and Fault Currents
- #12 Isolated Grounds, Instrumentation, and Special Grounding

COURSE TITLE	# MODULES	LENGTH	DELIVERY	PRICE / SEAT

COURSE # 201

Grounding & Earthing - Standard Course

(101 & 102 Combined)

# MODULES	LENGTH	DELIVERY	PRICE / SEAT
4	8 hours	2 days	$499

This eight-hour course combines the material in the Introduction to Grounding 101 Course with the material in the Applications to Grounding & Earthing 102 Course, and provides additional information about grounding electrodes, electrical code compliance, and basic information about human safety in high-voltage environments. This course includes materials covered in the "One-Hundred Series" of grounding and earthing classes. This course is delivered across 2 days, in 4 x 2-hour sessions.

#3	Electrical Basics & Purpose of Grounding	#4	Engineering Factors
#5	Introduction to Electrodes & Ground Faults	#6	Testing of Ground Systems (How to do the tests)

COURSE # 202

Grounding & Earthing -Enhanced Course

(201 plus Substation Step & Touch)

# MODULES	LENGTH	DELIVERY	PRICE / SEAT
8	16 hours	4 days	$999

This sixteen-hour course covers all of the material in the 201 course, and is enhanced with relevant material related to high-voltage substation electrical safety and IEEE 80. Training will include how the earth/soil impacts grounding and earthing systems, fault currents, and how to properly test the primary electrical safety mechanism (grounding and earthing systems) at substations. This course includes material covered in the "One-Hundred Series" of grounding and earthing classes, as well as the 201 course. This course is delivered across four-days, in eight 2-hour sessions.

#3	Electrical Basics & Purpose of Grounding	#4	Engineering Factors
#5	Introduction to Electrodes & Ground Faults	#6	Testing of Ground Systems
#9	Commissioning and Maintenance (Application of the Tests)	#11	Normal Operating and Fault Currents
#13	Earth/Soil	#14	Substation Step & Touch

OUR 400 SERIES COURSES OFFER MORE IN-DEPTH TRAINING AND IS PRESENTED BY **2 INSTRUCTORS**

COURSE # 401

Grounding & Earthing - Expanded Course

(Includes 201, 103, 104, 105)

# MODULES	LENGTH	DELIVERY	PRICE / SEAT
10	20 hours	5 days	$1,299

This twenty-hour course provides an in-depth education of grounding, earthing, and bonding; including ground/earth system testing, electrodes, electrical code compliance, human safety in high-voltage environments, sphere-of-influence, lightning strike, corrosion, telecom systems, neutral-to-ground bonds, electrical fault scenarios, and much more. This course includes materials covered in both the "One-Hundred Series" and "Two-Hundred Series" of grounding and earthing classes. This course is delivered across five-days, in ten 2-hour sessions.

#3	Electrical Basics & Purpose of Grounding	#4	Engineering Factors
#6	Testing of Ground Systems (How to do the tests)	#7	Lightning Protection Systems
#9	Commissioning and Maintenance (App of the Tests)	#11	Normal Operating and Fault Currents
#13	Earth/Soil	#15	Electrodes and Interaction to Earth: Part-1
#16	Electrodes and Interaction to Earth: Part-2	#17	EMI/EMF, Corrosion, Static, Pipeline

COURSE TITLE	# MODULES	LENGTH	DELIVERY	PRICE / SEAT

COURSE # 402

Grounding & Earthing - Extended Course *(Includes 401 plus Substation Step & Touch)*	12	24 hours	5 days	$1,499

This twenty-four hour course includes all of the material covered in the 401 course, plus supplemental training regarding IEEE 80 substations grounding, and isolated grounding systems for instrumentation and electronics. This course includes material covered in both the "One-Hundred Series" and "Two-Hundred Series" of grounding and earthing classes, as well as the 401 course. This course is given in across six-days, in twelve 2-hour sessions.

#3	Electrical Basics & Purpose of Grounding	#4	Engineering Factors
#6	Testing of Ground Systems (How to do the tests)	#7	Lightning Protection Systems
#9	Commissioning and Maintenance (App of the Tests)	#11	Normal Operating and Fault Currents
#12	Isolated Grounds, Instrumentation, Special Grounding	#13	Earth/Soil
#14	Substation Step & Touch	#15	Electrodes and Interaction to Earth: Part-1
#16	Electrodes and Interaction to Earth: Part-2	#17	EMI/EMF, Corrosion, Static, Pipeline

COURSE # 403

Grounding & Earthing - Advanced Course *(Includes 401 plus Advanced Testing)*	12	24 hours	5 days	$1,499

This twenty-four hour course includes all of the material covered in the 401 course, plus advanced training regarding real-world testing, and isolated grounding systems for instrumentation and electronics. This course includes material covered in both the "One-Hundred Series" and "Two-Hundred Series" of grounding and earthing classes, as well as the 401 and 402 courses. This course is delivered across six-days, in twelve 2-hour sessions.

#3	Electrical Basics & Purpose of Grounding	#4	Engineering Factors
#6	Testing of Ground Systems (How to do the tests)	#7	Lightning Protection Systems
#9	Commissioning and Maintenance (App of the Tests)	#11	Normal Operating and Fault Currents
#12	Isolated Grounds, Instrumentation, Special Grounding	#13	Earth/Soil
#15	Electrodes and Interaction to Earth: Part-1	#16	Electrodes and Interaction to Earth: Part-2
#17	EMI/EMF, Corrosion, Static, Pipeline	#18	Advanced Field Testing

COURSE TITLE	# MODULES	LENGTH	DELIVERY	PRICE / SEAT

COURSE # 405

Grounding & Earthing - Full Course Prime Power Providers (International Scale)	15	30 hours	5 days	$1,499

This special 30-hour course combines all the key modules within the 400-series, to include 401. 402, 403, and 450.

#3	Electrical Basics & Purpose of Grounding	#4	Engineering Factors
#6	Testing of Ground Systems (How to do the tests)	#7	Lightning Protection Systems
#9	Commissioning and Maintenance (App of the Tests)	#11	Normal Operating and Fault Currents
#12	Isolated Grounds, Instrumentation, Special Grounding	#13	Earth/Soil
#14	Substation Step & Touch	#15	Electrodes and Interaction to Earth: Part-1
#16	Electrodes and Interaction to Earth: Part-2	#17	EMI/EMF, Corrosion, Static, Pipeline
#18	Advanced Field Testing	#21	BS7671 Protection for Safety
#22	BS7671 Selection and Erection of Equipment	#23	BS7671 Inspection and Testing
#24	B-Code On-Site, Guidance Note-8, and BS7430		

COURSE # 450

British Electrical Code (BS7671) & International Electrical Code (IEC)	6	12 hours	3 days	$1,899

This twelve-hour course provides a detailed overview of the British Electrical Code BS7671 for those persons already familiar with the US National Electrical Code or the Canadian Electrical Code. The course will detail differences in terminology, how electrical systems are categorized, how the codes are similar, and how they differ. The course also details how BS7671 relates to the International Electrical Code (IEC). This course is delivered across three days, in six 2-hour sessions.

#19	Introduction to the IEC & BS7671	#20	BS7671 Assessment of General Characteristics
#21	BS7671 Protection for Safety	#22	BS7671 Selection and Erection of Equipment
#23	BS7671 Inspection and Testing	#24	British Codes: On-Site Guidance Note-8, and BS7430

MODULE #	TITLE	MODULE DESCRIPTION
1	Webinar	This module provides an introduction to several grounding and earthing core concepts, including: the purpose of grounding and earthing, the electrical systems that comprise an electrical grounding/earthing system, the sphere-of-influence theory, basics about electrodes, the types of testing related to grounding and earthing, and the basic components that make up grounding and earthing networks.
2	Grounding & Earthing System for Managers	This module is designed for the manager and executive in charge of facilities with high-voltage systems. Topics include cost-of-life, legal liabilities, regulatory responsibilities, maintenance policies, cost-benefit analysis for facility infrastructure, and other high-level discussions related to electrical systems. This training should help the facility manager make better-informed decisions related to grounding and earthing systems.
3	Electrical Circuits & the Purpose of Grounding	This module's training objective is to familiarize non-electrical personnel with the basic concepts of electrical circuits, while providing a quick refresher for those with an electrical education background. The fundamental purposes of grounding, earthing, and bonding is also covered and applicable for all levels of education and training.
4	Engineering Factors	One of our most popular modules! This walk-through of lightning striking a lattice tower shows the students all of the key engineering factors and electrical phenomena that occur inside of a structure when high-current strikes or fault events occur. Resistance-to-ground, GPR, GPD, leakage current, frequency spectrum & time domain, step & touch voltage hazards, and many other related topics are discussed at a basic level, providing the student an overall understanding of how grounding and earthing systems function to protect personnel and equipment.
5	Introduction to Electrodes & Ground Faults	This module is a compressed version of Modules 15 & 16 (the two-module course). It is designed to provide the student with a summarized understanding of the various electrodes as designated under the National Electrical Code and other regulatory Codes. Ground rods, plates, concrete-encased (Ufer) electrodes, water pipes, electrolytic electrodes, and more are covered.
6	Testing of Ground Systems (How to Perform the Tests)	This module covers the testing and measurement of grounding and earthing systems for two of three major testing methodologies. Students learn the concepts of how to properly conduct ground continuity measurements (2-point) and resistance-to-ground measurements (3-point), in detailed review. The measurement of soil resistivity (4-point) is not discussed (refer to Module 9 for this method). This module is primarily theory and understanding what the results indicate.
7	Lightning Protection Systems	This module cover the basics of lightning and how it propagates through the atmosphere, how lightning systems work, and the basics of NFPA 780 Lightning Protection Systems (LPS). The module will have an emphasis on the five (5) strike scenarios that can impact a given facility, and how a proper LPS system will protect the structures.
8	Advanced Lighting Protection Systems	This is a supplemental advanced module to the information provided in Module 7. It additionally covers information regarding lightning protection for substations (IEEE 998) and the International Lightning Protection Standard BS EN/IEC 62305. Lightning Risk Assessments, rolling-sphere analysis, and other scientific methods are discussed. Some installation methods are discussed, but it is not the primary training objective of the course.
9	Commissioning & Maintenance (Application of the Tests)	This module is rapidly becoming a student favorite! In this module, the student is walked-through various facilities and shown how the 2-point continuity test, the 3-point resistance-to-ground test, and the 4-point soil resistivity test, all can be used to determine the integrity of a complex buried grounding and earthing conductor network. At the end of the module, the students will be given a real-world scenario, in which they will be able to demonstrate an understanding of what varying test results mean in differing conditions.
10	Telecom Standards	This module will discuss the standards and requirements for cell sites, data centers, and other sensitive electronic systems. Grounding and earthing requirements as found in Motorola's R56, AT&T's Standard ATT-TP-79416, and ANSI/TIA-STD-607-D will be discussed. The infamous 5-ohm resistance-to-ground requirement will be investigated with the students so that a full understanding of this requirement is achieved.

MODULE #	TITLE	MODULE DESCRIPTION
11	Normal Operating and Fault Currents	The student is walked through an electrical ground fault from the load in a typical home, all the way back through the utility power system to the source power generation. Electrical ground faults are investigated through an electrical system, from transformer-to-transformer, and substation-to-substation, so they better understand the role that grounding and earthing plays in the electric utility infrastructure. A review of transfer switches and the grounding of standby generators is included. The student will achieve an understanding of the neutral-to-ground bond requirements found in the NEC.
12	Isolated Grounds, Instrumentation, and Special Ground for Electronics	This module will review isolated grounding and earthing systems, what their purpose is, how they function in normal operating and fault current scenarios, and how to properly wire these systems. Testing of isolated grounds is also discussed. This includes grounding and earthing scenarios for instrumentation and electronic equipment.
13	Earth/Soil	This module reviews the importance of the earth (soil) to grounding and earthing systems, how changes in the soil impacts grounding systems, how temperature and other seasonal weather events impact the performance of earthed-electrodes. Training includes how to properly measure soil resistivity using the Wenner 4-pin method. Proper soil modeling vs. apparent resistivity is discussed, as well as the impact of multi-layer soil models on grounding and earthing systems.
14	Substation Step & Touch	This module is designed to provide detailed review of substation electrical safety as related to IEEE Std. 80. Human safety in high voltage environments will be the emphasis. The module will walk the student through the steps of designing a safe substation grounding and earthing grid, as presented in IEEE Std. 80.
15	Electrodes and Interaction to Earth: Part 1	This module is Part 1 of a two-module course designed to provide the student with an in-depth understanding of the various electrodes as designated under the National Electrical Code and other regulatory codes. Training includes how these electrodes function, how they are to be bonded, and the advantages and disadvantages of each electrode type. Ground rods, plates, concrete-encased (Ufer) electrodes, water pipes, electrolytic electrodes, and more are covered.
16	Electrodes and Interaction to Earth: Part 2	This module is Part 2 of a two-module course designed to provide the student with an in-depth understanding of the various electrodes as designated under the National Electrical Code and other regulatory codes. Training includes how these electrodes function, how they are to be bonded, and the advantages and disadvantages of each electrode type. Ground rods, plates, concrete-encased (Ufer) electrodes, water pipes, electrolytic electrodes, and more are covered.
17	EMI/EMF, Corrosion, Static, Pipeline	Covers Electromagnetic Interference (EMI) and Electromagnetic Fields (EMF), how they are generated, the differences between inductive, capacitive, and resistive coupling, electric and magnetic fields, and more. The module will discuss how various structures such as pipelines and fences are impacted by the EMI/EMF generated by overhead power lines, and how grounding and earthing system can help alleviate the problems. Static control systems will also be briefly discussed.
18	Advanced Field Testing	Advanced supplement to Modules 6 and 9, and will involve intense student participation. The training objective is to answer specific test scenarios most applicable to the students in the course. Augmented Reality (AR), backdrop photos, video, and other electronic systems may be used to help the student understand the specific testing scenario in question. Proper methods, procedures, and equipment will be discussed as needed. Students are encouraged to provide relevant questions to the instructor(s) in advance of the course.
19	Introduction to the IEC and BS7671	Two-thirds of the world use the International Electrical Code or some version of it. The British Standard BS7671 is used as guideline for understanding the most common electrical system on the planet. Discussions on how the standard is setup, regulatory information, and other aspects of the standard are covered. The differences between the US National Electrical Code and the IEC are discussed.
20	BS7671 Assessment of General Characteristics	This module covers Part 3 of BS7671, one of the most important aspects of the IEC and BS7671, the understanding of the general characteristics of electrical systems. Not only will the student have a full understanding of the electrical system identification requirements found in the international code, but they will have a better understanding of the neutral-to-ground bond requirements found in the US electrical code.

MODULE #	TITLE	MODULE DESCRIPTION
21	BS7671 Protection for Safety	This module will discuss the requirements found in Part 4 of BS7671. The requirements for protecting persons from electric shock, thermal effects, over-current, voltage disturbances, and electromagnetic disturbances will be discussed.
22	BS7671 Selection and Erection of Equipment	This module covers the requirements found in Part 5 of BS7671, the selection and erection of equipment. Common rules, erection of wiring systems, protection, isolation, switching, and other requirements are briefly covered. Earthing arrangements and protective conductors are discussed at length.
23	BS7671 Inspection & Testing	This module covers Part 6 of BS7671, the inspection and testing of electrical systems. This module will discuss the various testing requirements found in the code, with an emphasis on the earth electrode resistance and the earth fault loop impedance tests.
24	British Codes On-Site Guide, Guidance Note-8, & BS7430	Covers the various other standards, guidance notes, and books that make up the complete British Standard electrical system, as related to earthing systems. The differences between the US and the international standards will be a particular emphasis within the discussions.
25	Custom Coursework	Modules can be customized and tailored to fit specific needs unique to your requirements. Contact E&S Grounding Solutions today to discuss your customized courses.

Special Note 1: *The nature of the Coursework and the criticality of certain engineering principles may present instances of recurring themes and materials from one module to the next. This methodology is to ensure that each module delivers all stated objectives. In rare situations some modules may appear slightly repetitive in sections.*

Special Note 2: *E&S Instructors seek to closely follow the relevant Coursework agenda while striving to balance the pre-allocated time for Student's Questions and E&S Answers. In some cases balancing the instruction in such a way could cause the agenda to become slightly modified from original Coursework, but only if Students collectively agree with the adjustment.*

Ready to get started?

Click to email or call us at: 310.318.7151

training@esgrounding.com

E&S reserves the right to cancel or reschedule any Live Instruction Courses/Modules due to insufficient registrations [minimum eight (8) required from all sources per Course], Instructor illness, or other reasonably unanticipated circumstances beyond E&S direct control. In such circumstances, E&S will seek to provide maximum notice, but in some cases, may only be a 24-hour notice prior to start of Training Session. Registered Attendees/Students will have option for a Full Refund of the amount paid, or agree to attend the future rescheduled Course, typically within 90 days of original date at no additional cost. If for any reasons E&S must cancel the subject Course, registered Attendees will receive Full Refund of amount paid. E&S cannot be held liable for any other penalties, expenses, or extended damages that may be incurred due to the cancellation or reschedule of any of our Training Products beyond the original price paid.

Our Customer Testimonials

E&S Grounding instructors David Stockin and Jeffrey Drummond have strong theoretical and practical backgrounds in grounding for industrial, utility and generating plant applications, but more importantly they are effective teachers. Our employees and extended enterprise customers have benefits their deep understanding of basic grounding concepts, safety considerations, field testing and troubleshooting and advanced engineering concepts.

DOBLE ENGINEERING COMPANY
Brian Snyder / Solutions Director, Professional Services

The Petro Guardian team recently had the opportunity to bring in the E&S Grounding Solutions team for training and we appreciated the flexibility their course offered. The E&S team adapted their curriculum to meet our unique needs, which kept our group engaged and attentive throughout the entire class. They were able to take advanced subject matter, like 3-point fall-of potential and ground loop testing, and present it in a way that was understandable by employees no matter what their experience level may have been. My team and I would highly recommend the E&S Grounding Solutions team and we look forward to working with them again in the future.

PETRO GUARDIAN
Robert Morris / President

The Calpine team attended the introduction to Grounding and Earthing course provided by E&S Grounding Solutions. The course comprised of two online sessions of two hours each. The presenters David and Jeffrey have a very relaxed style that engaged the team to participate and ask questions. The course covers the basic concepts of grounding and is a good introduction to subject. The presenters develop the concepts throughout the presentation which helps in the understanding of this complex topic. I recommend this course for people of all technical abilities who want to gain an understanding of the basics of Grounding & Earthing.

CALPINE CORPORATION
Mick Deacon / Manager Electrical Engineering