### Advanced Technical Seminar on Electrical System Grounding & Electromagnetic Interference Analysis and CDEGS Level I Certification

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Course Fees</th>
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<tbody>
<tr>
<td>The Leela Ambience,</td>
<td>July 06 – 10, 2020</td>
<td>Local Resident Attendees: INR 40,000*</td>
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<tr>
<td>Ambience Island, National</td>
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<td>Foreign Attendees: US$ 2,000*</td>
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<td>Highway 8, Gurugram - 122</td>
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<td>Local Academic Attendees: INR 20,000*</td>
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* GST @ 18% would be applicable on the course fee
Course Objective

This course provides attendees with a unique opportunity to acquire practical and up-to-date engineering knowledge, from the world's leading specialists and researchers, on how to study and design efficient and economical earthing and lightning mitigation systems. Whether you wish to protect a power system, plant or a nearby utility subjected to electromagnetic interference from power system faults, lightning or switching surges, this course will present pertinent principles for utility, industrial and various public installations, during steady state, fault and transient conditions, using realistic models of the environment.

The emphasis will be put on demonstrating scientific concepts using practical examples drawn from the extensive number of research projects and engineering studies conducted by SES researchers since 1978. Pertinent analytical derivations are included in the extensive Reference Manual made available to all course participants. One of the main goals of this course is to 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.

Course Outline

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

Part II is entirely devoted to a workshop aimed at learning how to use SES powerful input and output processors such as SESCAD, ROWCAD and SESShield-3D.

In Part III 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 victim lines or circuits will be 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, will be described and typical analysis methods and computation results explained.
# COURSE OUTLINE

## PART I - Fundamental Concepts and Power Frequency Analysis

### Monday (July 06, 2020)

<table>
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<th>Session 1</th>
<th>Session 2</th>
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<td>9:30 am - 1:00 pm</td>
<td>2:00 pm - 5:30 pm</td>
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**Fundamental Concepts, Soil Models and Resistivity, SES Software Packages**

- Electric energization modes
- Soil structure models and characteristics
- Impedance Concepts
- Soil resistivity measurement and interpretation
- Noise analysis & suppression
- “How far is far enough”
- Computer Workshop

**Earthing System Analysis & Design**

- Theory of earthing system analysis
- Return electrodes and buried structures
- Horizontal, vertical, hemispherical, cylindrical soil layering and finite volume soils
- Design optimization to reduce GPR, touch and step voltages
- Computer Workshop

### Tuesday (July 07, 2020)

<table>
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<th>Session 3</th>
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<td>9:30 am - 1:00 pm</td>
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**Earth Impedance Concepts and Measurement & Interpretation**

- Fall-of-Potential measurement technique
- Earth impedance measurement and interpretation
- Noise analysis & suppression
- Electrical shock mechanisms
- Body current thresholds, IEEE Std. 80; IEC 479; effects of frequency; heart current factors
- Body impedance, Foot resistance and Thevenin concepts
- Computer Workshop

**Fault Current Distribution in Power System Networks and Line Parameters**

- Fault current computation - simplified methods
- Multiple terminal systems; modeling of shield wires, neutrals and counterpoises
- Steady-state conditions, harmonics and unbalances
- Fault current computation – detailed methods
- Computation of self and mutual impedances and capacitances of overhead and buried conductors; uniform and layered soils
- Modeling of transformers
- Computer Workshop
# PART II - SES Graphical Input and Output Processors Workshop

**Wednesday (July 08, 2020)**

**Session 5**  
9:30 am - 1:00 pm

**SES Integrated Graphical Input Environment SESCAD**
- Using SESCAD Basic Features and Tools
- Advanced Features: Insert, Define, Display, Tools, Advanced
- Display and View
- Options
- Import and Export
- Running and Exploring Results from SESCAD

**Session 6**  
2:00 pm - 5:30 pm

**Other Graphical Software Packages and Tools**
- SESSystemViewer
- GRSERVER
- ROWCAD
- GRSPLITS3D
- SESHIELD3D and SESCAD
- SES Tools

# PART III – EMI, High Frequency and Transient Analysis

**Thursday (July 09, 2020)**

**Session 7**  
9:30 am - 1:00 pm

**Electromagnetic Interference, Environmental and Mitigation Techniques**
- Inductive, Capacitive and Conductive interference mechanism
- Modeling of pipelines and buried metallic structures
- Grounding design of valve and test stations
- Combined influence of inductive and conductive coupling and mitigation
- Effects of coating characteristics
- Environmental impact assessment
- Mitigation techniques and cathodic protection issues
- **Computer Workshop**

**Session 8**  
2:00 pm - 5:30 pm

**Effects of Frequency on Grounding Systems, large grounding systems**
- Description of the field approach
- Frequency dependence of conductors
- Performance at high frequency
- Extensive grounding systems
- Effect of conductor characteristics on performance of grounding system
- Effects of circulating current from local generators in grounding study of a large power plant
- Modeling Cables, GIS and GIL Systems
- Induction to communication and protection circuits
- Stress voltage reduction
- **Computer Workshop**

**Friday (July 10, 2020)**

**Session 9**  
9:30 am - 1:00 pm

**Session 10**  
2:00 pm - 4:00 pm
Electrical and Magnetic Fields, Transients and Lightning Shielding - I

- Lightning shielding analysis
- Capacitor switching in substations
- Computation of electric and magnetic fields
- Lightning transient studies
- Computer Workshop

Electrical and Magnetic Fields, Transients and Lightning Shielding - II

- Comparison of circuit and field approaches
- Additional topics selected by attendees
- Submission of CDEGS Level I Certification exam documents
- Distribution of Certificates

End of Sessions

Course Instructors

The principal course lecturer will be Dr. Farid Dawalibi, an internationally recognized expert and authority in earthing and electromagnetic interference. In addition to his pioneering research work, Dr. Dawalibi was the project leader of the team which developed the GATL and ECCAPP software packages (EPRI EL2699 and EL5472) and the AUTOGRID® software package (CEA 249 D 541). He is presently the Director of Engineering and R&D and is responsible of the research department in charge of developing and maintaining CDEGS®, the most advanced and powerful earthing and electromagnetic interference software package. Dr. Dawalibi has published over 450 technical papers, research and engineering reports and has presented more than 150 technical seminars and short courses. He has written part of ANSI/IEEE Standard 80 and he has also served as an expert witness at several challenging court hearings and is a technical advisor and industry consultant to several leading power, pipeline and railway utilities.

Course Fee

The course fee includes an extensive Reference Manual entitled "Power System Interaction with Earth and Industrial Utility Installations," annotated copies of course display materials, and several copies of pertinent technical papers published by the instructors. The fee also includes a full course lunch, coffee tea and refreshments during the morning and afternoon sessions. Participants are requested to bring their own laptops for the workshop portion of the seminar. SES will provide software on a complimentary 16 GB USB 3.0 data drive and software protection key for the duration of the seminar. More information will be provided to prospective participants when they enroll.

Professional Development and SES Certification

All participants will be issued a certificate of completion and awarded the equivalent of 3.5 CEU (Continuing Education Unit) or 35 PDH (Professional Development Hours). The CEU and PDH are recognized units for recording participation in noncredit educational programs.

Those who wish to participate in the Level I certification and pass the Level I certification tests will receive by mail SES Level I certification that will make them eligible for future Level II and Level III certifications.

Cancellation Policy

SES reserves the right to cancel or change the dates or location of any of the seminars. In this case, participants will be notified immediately and any fee received will be refunded in full. However, SES will not be responsible for travel-related or other expenses incurred by participants.
### How to Enroll

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<th>Call:</th>
<th>Mr. Soam Prabh Upadhyay Tel: +91-120-4133662/4133663</th>
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<tbody>
<tr>
<td>Email:</td>
<td><a href="mailto:Seminar@sestech.in">Seminar@sestech.in</a></td>
</tr>
<tr>
<td>Alt Email:</td>
<td><a href="mailto:soam.upadhyay@sestech.in">soam.upadhyay@sestech.in</a></td>
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### Seminar Locations and Information

Bring yourself to the forefront of power system grounding and electromagnetic interference technology with a total of 5 days course presenting not only basic theory and practical considerations associated with power system grounding, AC interference mitigation and EMI/EMF analysis, but also giving you ample opportunity to work with state of the art software tools as part of hands-on sessions. These sessions are designed to familiarize you with modern computer modeling techniques and give you an intuitive feel for how grounding systems behave, based on the vivid graphics that these modeling techniques can provide. At the same time, you will meet leading researchers in the field, who can help you distinguish between age-old myths and reality and gives you new perspective on your present work. Furthermore, the courses provided by SES give you an opportunity to network with other attendees doing similar work.

#### Seminars Hotel

**Seminar – Gurugram, Delhi (N.C.R.)**

**THE LEELA AMBIENCE**

Ambience Island, National Highway 8, Gurugram - 122 002

For seminar participants, accommodation is also available at discounted price at the hotel. Please call Mr. Abhinav Mathur @ +91- 9560453924 and mention **Group code SESSES1**