



an eegis company

بروجاكس للتدريب والتطوير
Projacs Training and Development

Electrical Fault Analysis, Causes, Detection and Remedies

تحليل الأخطاء والاعطال الكهربائية واصلاحها

11 – 15 July 2021

Cairo / Egypt



PROJACS ACADEMY



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Introduction

It is essential to know the effects of electrical faults that the electrical system may facing and will carry under different fault conditions and at different points in the system. The faults may be single line to ground, double line to ground, three line fault or line to line fault. Selection of circuit breakers, protective devices are mainly required information about the short circuit current. Moreover fault analysis is essential in order to have safety operation of the power systems and to know the fault causes. It is important for engineers and technicians to be aware by fault causes, fault detection, fault protection and fault analysis. This course is designed to provides the participants with complete knowledge about fault calculations, fault detection and protective relays used for power systems and networks. This include the overcurrent, impedance, voltage, directional, differential relays. Generators, motors and transformer faults and protection are also included. External fault causes such as lightning, pollution, switching, harmonic and transients are also outlined. Some study cases will presented using computer application.

Who Should Attend?

The course is designed to electrical engineers and highly qualified technicians whom working in electrical distribution, transmission, operation and protection of the electrical power systems.

Course Outline

Day 1

1. Power System Sources and Configurations

- Electrical engineering basic concepts,
- Voltage levels,
- One line and three line diagram,
- Generation system layout,
- Transmission layout,
- Distribution layout,
- Substation layout,
- Case study

2. Utility Load Classifications

- Residential loads
- Commercial loads
- Power factor
- Power factor correction
- Utility factor
- Losses in lines

3. The Per Unit System

- General
- Single-Phase System
- Three phase system
- Transformer Representation in the Per Unit System
- System Analysis in the Per Unit System
- Transformers with Off-Nominal Turns Ratios
- Summary
- Case study

Day 2

4. Symmetrical Components and Fault Analysis

- General
- Transformation of Phase Quantities to Sequence Quantities
- Line and Cable Sequence Impedances
- Transformer Sequence Networks
- Rotating Machine Sequence Networks
- Sequence Filters
- Study case

Faults Analysis in Electrical Power System

- Abnormal operating conditions
- **Electrical Faults**
- Type of faults
- Generator faults
- Motor faults
- Transformer faults
- Cables faults
- Feeders faults

External Faults Analysis

- Lightning
- Pollution
- Switching
- Transients

- Harmonics

5. Short Circuit Calculations and Circuit Interruption

- General
- The per unit system
- Symmetrical components
- Symmetrical and Asymmetrical Fault Currents
- Three phase Faults
- Line to Line Faults
- Line to Line to Ground Faults
- Line to Ground Faults
- Line to Ground Faults through Impedance
- Equivalent System Impedance
- Current-Limiting Inductors
- Short circuit level
- Effect of induction machines on short circuit level
- CB rupture capacity
- Numerical Examples of Short-Circuit calculations

Computer Programs for Short Circuit Faults Calculation

- Power system representation
- EMTP program
- ATP program

Day 3

6. Types of Earthing and Fault Current Level

- Introduction
 - Selection of Grounding Method
 - Selection of Grounding System
 - Understanding Ground Resistance
 - Ground Resistance Values
 - Ground Resistance Measurements
 - Ground Grid Integrity Measurements
- Effect of type of earthing on fault current level

7. Protective Equipment and Relaying Principles

- Fuses,
- Auto-reclosers,
- Automatic sectionalizer,
- Breakers,
- Isolators,

- Load switches,
- Relays,
- Thermal relays,
- Electromagnetic relays,
- Static relays,
- Digital relays

Day 4

8. Feeders Fault Analysis and Protection.

- Introduction
- Transmission lines faults
- Transmission line protection
- Defiant minimum time relays
- Inverse time delay over current relays
- Relay time-current characteristics
- Setting rules
- Pick up setting
- Time delay setting
- Case study
- Relays coordination
- Male and false operation considerations
- Case study

Instantaneous Over Current Relays

- Application
- Setting rules
- Case study
- Earth fault relay
- Male and false operation considerations

9. Directional over Current Relays

- Introduction
- Application
- Directional control
- Directional overcurrent
- Polarizing signals
- Power directional relays
- Fault directional relays
- Male and false operation considerations
- Case study

Day 5

10. Power Transformers Fault Analysis and Protection

- Types of faults,
- Through faults,
- Internal faults,
- Gas actuated relays,
- Buchholz relays,
- Sudden pressure relays, Electrical relays,
- Earth fault relays,
- Restricted earth fault relays
- Differentials relays,
- Transformer with grounded neutral,
- Generator transformer unit protection,
- Case study.

11. Motor and Generators Fault Analysis and Protection

- Stator faults,
- Phase fault,
- Ground fault,
- Rotor faults,
- Unbalance current,
- Overload,
- Over speed,
- Abnormal voltage and frequency,
- Over voltage, under voltage,
- Over frequency, under frequency,
- Loss of excitation
- Over fluxing

Training Method

- Pre-assessment
- Live group instruction
- Use of real-world examples, case studies and exercises
- Interactive participation and discussion
- Power point presentation, LCD and flip chart
- Group activities and tests
- Each participant receives a binder containing a copy of the presentation
- slides and handouts
- Post-assessment

Program Support

This program is supported by interactive discussions, role-play, and case studies and highlight the techniques available to the participants.

Schedule

The course agenda will be as follows:

- Technical Session 08.30-10.00 am
- Coffee Break 10.00-10.15 am
- Technical Session 10.15-12.15 noon
- Coffee Break 12.15-12.45 pm
- Technical Session 12.45-02.30 pm
- Course Ends 02.30 pm

Course Fees*

- **2,950USD**
**VAT is Excluded If Applicable*

مقدمة

من الضروري معرفة آثار الأعطال الكهربائية على النظام الكهربائي التي قد تواجهه في الظروف المختلفة و ذلك يجب تحليل الاخطأ من أجل أن يكون الحفاظ على سلامة أنظمة الطاقة ومعرفة أسباب الخطأ. حيث انه من المهم للمهندسين والفنيين ان يكونو على بينة من أسباب الخطأ، ليتكنو من الكشف عن الخطأ، الحماية الاخطأ. تم تصميم هذا البرنامج ليوفر للمشاركين معرفة كاملة عن حسابات الاخطأ، والكشف عن الاخطأ ومرحلات الحماية المستخدمة لأنظمة الطاقة والشبكات. حيث هذه تشمل مرحلات التيار الزائد، مقاومة، والجهد، الاتجاه، التفاضلية. كما تشمل المولدات والمحركات والمحولات الاخطأ الخارجيه مثل البرق، والتلوث،. وسوف تقدم قدمت الدورة بعض الحالات باستخدام تطبيقات الحاسوب.

الحضور

تستهدف الدورة المهندسين الكهربائيين والفنيين المؤهلين تأهيلا عاليا الذين يعملون في توزيع الطاقة الكهربائية ونقلها وتشغيل وحماية أنظمة الطاقة الكهربائية.