

POWER SYSTEM PROTECTION TRAINING COURSES

Staying in tune is
vital to producing
the right notes.

PEARL can help
you to stay in
tune.

PEARL offers a wide range of
Power System Protection courses
to meet the needs of every Power System Professional.



Protection Engineering
And Research Laboratories

Protection Engineering And Research Laboratories

power system protection training

ABOUT US

Protection Engineering And Research Laboratories provides expert technical solutions in the field of Power System Protection and Automation. At PEARL we have highly qualified people with over a decade of industrial and academic experience. We have expertise to offer in a wide range of activities including research, design, application, engineering and on-site troubleshooting.

With a vision to become a global centre of excellence in the field of Power System Protection and Automation, we at PEARL are committed to our core values viz., Innovation, Integrity, Quality, Commitment and Customer Relationship.

PEARL offers an exhaustive list of training courses covering Power System Protection design, application, operation and maintenance. We also coordinate with our customers to develop new courses on topics in Power Systems to meet their training needs.

We have conducted training programs for participants from different parts of Asia. We have experience in training engineers from power generation, transmission and distribution utilities and also from different types of industries including steel, oil and gas, cement and aluminum.

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An investment in knowledge always pays the best interest.

- Benjamin Franklin

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Learning is a continuous process and enables one to be competitive in their field. Successful organizations across the world are giving more emphasis on training their staff regularly. With technology changing continuously and power system growing in complexity & size, updating the knowledge of the power system operation, maintenance and design staff has become a necessity. In addition to increasing the efficiency and quality of the staff, it also increases the general job satisfaction level and helps in retaining employees.

Consistent with this belief and built on a strong experience in the field of Power System Protection and Automation, PEARL offers an extensive range of training modules for practicing professionals at different capacities, from fresh to experienced engineers. Our training modules cover the entire spectrum of power system protection, including generation, transmission, distribution and industrial systems and are designed to suit professionals at different responsibilities such as research, design, application, operation & maintenance, testing & commissioning, etc. We can also create new modules to meet specific requirements of our customers.

The highlights of our training programs are our highly skilled faculty and our flexibility in customizing the modules to the needs of the trainees. Our courses package a wealth of fundamental knowledge, theoretical studies, several numerical examples and are enriched with real field case studies.

Since 2007 we have trained over 1900 participants. We also provide faculty support to other leading protection device manufacturers to provide training to their customers.

Courses

power system protection training

MODULES	CODE	DURATION (DAYS)
Protection Application for Power Generation Systems	PAG	3
Protection Application for Power Transmission Systems	PAT	3
Protection Application for Power Distribution Systems	PAD	3
Protection Application for Industrial Systems	PAI	4
Basics of Numerical Relays & Communication	NRC	3
Advanced Over Current Protection	ACP	2
Advanced Generator Protection	AGP	3
Advanced Line Protection	ALP	3
Advanced Motor Protection	AMP	2
Advanced Transformer Protection	ATP	2
Advanced Fault Analysis	AFA	3

Customizing Courses

Customers can choose from any of the modules above or combine multiple modules to design a course. Details of each module is provided in the following pages.

We can also develop courses in any subject related to power system and protection, specifically suited to the needs of any industry.



FACULTY

We have well qualified faculty with good academic qualifications and considerable industrial and field experience. Our faculty have experience in training practicing professionals from leading utilities and industries around the world and also have knowledge on protection devices of all major manufacturers. This provides us with a unique advantage of being able to discuss and address questions relating to different operating philosophies and products from a wide range of manufacturers.

Course details

power system protection training

Protection Application for Power Generation Systems (PAG)

3 days

Contents

- Introduction to power system protection
- Steady state fault analysis
- Theory of instrument transformers
- Theory & application of generator protection
- Theory & application of transformer protection
- Theory & application of motor protection
- Theory & application of bus bar protection

Pre-requisites

To be effective the minimum pre-requisite for this course is a graduate electrical engineering degree or diploma. Participants with ITI certification must have at least two years of relevant work experience to enable easy learning in this course.

PARTICIPANTS

Practicing engineers working in power generation utilities, independent power producers, captive power plants and consultants will benefit from this course. To derive maximum benefit from the course, we recommend that only participants with electrical engineering background take up this course. Participants could be technicians, operations staff, planning engineers, maintenance engineers, application engineers or commissioning engineers.

LEARNING

After successful completion of this course, participants would be able to understand the fundamental philosophy of power system protection. They would also gain knowledge on basic fault analysis, helping them to analyze system events and perform post fault trouble shooting and suggest improvements. Participants of this course would also learn the operating principles of all protection systems present in a generation station (such as generator, transformer, motor and busbar protection). They would also learn the technical issues behind selection of instrument transformers for a given application. With the knowledge gained in this course, they would be able to operate and maintain the protection system of an electrical power generating plant better and also perform effective and fast trouble shooting when required.



Course details

power system protection training

Protection Application for Power Transmission Systems (PAT)

3 days

PARTICIPANTS

Practicing engineers working in power transmission utilities, large industries, transmission system operators and consultants will benefit from this course. To derive maximum benefit from the course, we recommend that only participants with electrical engineering background take up this course. Participants could be technicians, operations staff, planning engineers, maintenance engineers, application engineers or commissioning engineers.

LEARNING

After successful completion of this course, participants would be able to understand the fundamental philosophy of power system protection. They would also gain knowledge on basic fault analysis, helping them to analyze system events and perform post fault trouble shooting and suggest improvements. Participants of this course would also learn the operating principles of all protection systems present in a power transmission systems (such as distance, transformer, line differential and busbar protection). They would also learn the technical issues behind selection of instrument transformers for a given application. With the knowledge gained in this course, they would be able to operate and maintain the protection system of an electrical power transmission system better and also perform effective and fast trouble shooting when required.



Contents

- Introduction to power system protection
- Steady state fault analysis
- Theory of instrument transformers
- Theory & application of distance protection & schemes
- Theory & application of transformer protection
- Theory & application of line differential protection
- Theory & application of bus bar protection

Pre-requisites

To be effective the minimum pre-requisite for this course is a graduate electrical engineering degree or diploma. Participants with ITI certification must have at least two years of relevant work experience to enable easy learning in this course.



Course details

power system protection training

Protection Application for Power Distribution Systems (PAD)

3 days

Contents

- Introduction to power system protection
- Steady state fault analysis
- Theory of instrument transformers
- Theory & application of non-directional over current protection & co-ordination
- Theory & application of directional over current protection
- Theory & application of transformer protection
- Theory & application of line differential protection

Pre-requisites

To be effective the minimum pre-requisite for this course is a graduate electrical engineering degree or diploma. Participants with ITI certification must have at least two years of relevant work experience to enable easy learning in this course.

PARTICIPANTS

Practicing engineers working in power distribution utilities, industries and consultants will benefit from this course. To derive maximum benefit from the course, we recommend that only participants with electrical engineering background take up this course. Participants could be technicians, operations staff, planning engineers, maintenance engineers, application engineers or commissioning engineers.

LEARNING

After successful completion of this course, participants would be able to understand the fundamental philosophy of power system protection. They would also gain knowledge on basic fault analysis, helping them to analyze system events and perform post fault trouble shooting and suggest improvements. Participants of this course would also learn the operating principles of all protection systems present in power distribution systems (such as over current, earth fault, transformer and line differential protection). They would also learn the technical issues behind selection of instrument transformers for a given application. With the knowledge gained in this course, they would be able to operate and maintain the protection system of an electrical power distribution system better and also perform effective and fast trouble shooting when required.



Course details

power system protection training

Protection Application for Industrial Systems (PAI)

4 days

PARTICIPANTS

Practicing engineers working in all types of industries and consultants will benefit from this course. To derive maximum benefit from the course, we recommend that only participants with electrical engineering background take up this course. Participants could be technicians, operations staff, maintenance engineers, planning engineers, application engineers or commissioning engineers.

LEARNING

After successful completion of this course, participants would be able to understand the fundamental philosophy of power system protection. They would also gain knowledge on basic fault analysis, helping them to analyze system events and perform post fault trouble shooting and suggest improvements. Participants of this course would also learn the operating principles of all protection systems present in an industrial power systems (such as over current & earth fault, transformer, motor, line differential and capacitor bank protection). They would also learn the technical issues behind selection of instrument transformers for a given application. With the knowledge gained in this course, they would be able to operate and maintain the protection system of any kind of industrial power system plant better and also perform effective and fast trouble shooting when required.

Contents

- Introduction to power system protection
- Steady state fault analysis
- Theory of instrument transformers
- Theory & application of non-directional over current protection & co-ordination
- Theory & application of directional over current protection
- Theory & application of transformer protection
- Theory & application of line differential protection
- Theory & application of capacitor bank protection
- Theory & application of motor protection

Pre-requisites

To be effective the minimum pre-requisite for this course is a graduate electrical engineering degree or diploma. Participants with ITI certification must have at least two years of relevant work experience to enable easy learning in this course.



Course details

power system protection training

Basics of Numerical Relays and Communication (NRC)

3 days

Contents

- Introduction to protection technology and its evolution
- Numerical relay hardware architecture
- Phasor estimation algorithms
- Frequency estimation algorithms
- Protection algorithms
- Fundamentals of numerical relay and substation communication

Pre-requisites

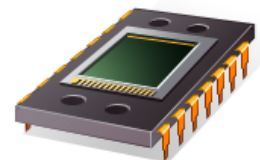
To be effective the minimum pre-requisite for this course is a graduate electrical engineering degree or diploma. Participants with ITI certification must have at least two years of relevant work experience to enable easy learning in this course.

PARTICIPANTS

Practicing engineers working in power utilities, independent power producers, captive power plants, industries and consultants will benefit from this course. To derive maximum benefit from the course, we recommend that only participants with electrical engineering background take up this course. Participants could be technicians, operations staff, maintenance engineers, planning engineers, design engineers, product development engineers, application engineers or commissioning engineers.

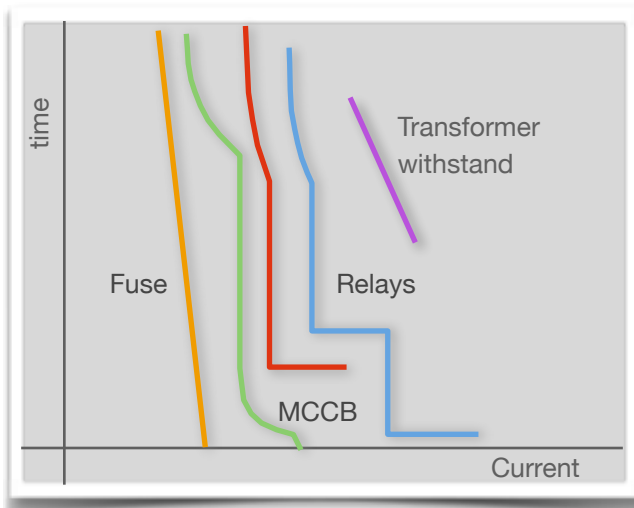
LEARNING

After successful completion of this course, participants would be able to understand the technology that drives numerical protection devices and substation communication. They would gain knowledge on hardware and software building blocks of the numerical relay architecture, helping them to understand the operation of numerical relays. Participants of this course would also learn various numerical algorithms used for extracting phasors and frequency estimation. They would also learn about substation communication and latest substation communication protocols. With the knowledge gained in this course, they would be able to operate and maintain the numerical protection devices installed in their plant and also perform effective, fast trouble shooting when required.



Course details

advanced power system protection training



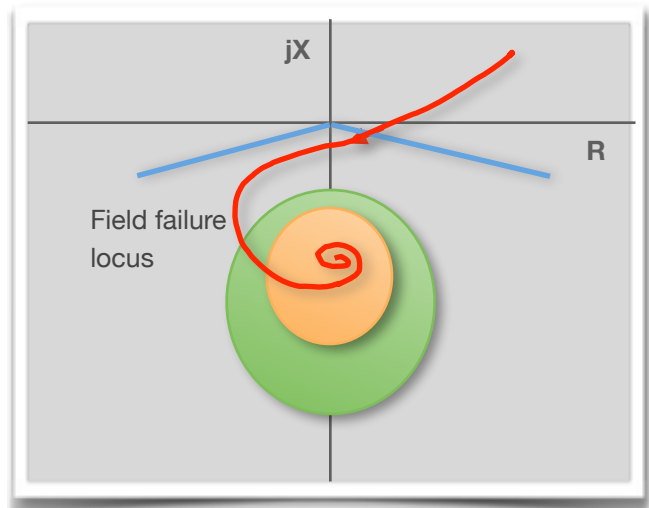
Advanced Over-Current Protection (ACP) - 2 days

CONTENTS

- Steady state fault analysis
- Non-directional over-current and earth fault protection
- Directional over-current and earth fault protection
- Over-current & earth fault relay co-ordination procedure and tutorial
- Current transformer requirements for over-current and earth fault protection
- Testing and commissioning of over-current and earth fault protection systems

OBJECTIVES

This course will help electrical engineers to apply directional and non-directional over current relays to protect power system equipment. Participants of this course will gain knowledge to select the correct type of over-current & earth fault protection, calculate the settings to be adopted and to specify the optimum current transformers. The course will also provide them with knowledge required to find solutions for challenging situations in the field.



Advanced Generator Protection (AGP) - 3 days

CONTENTS

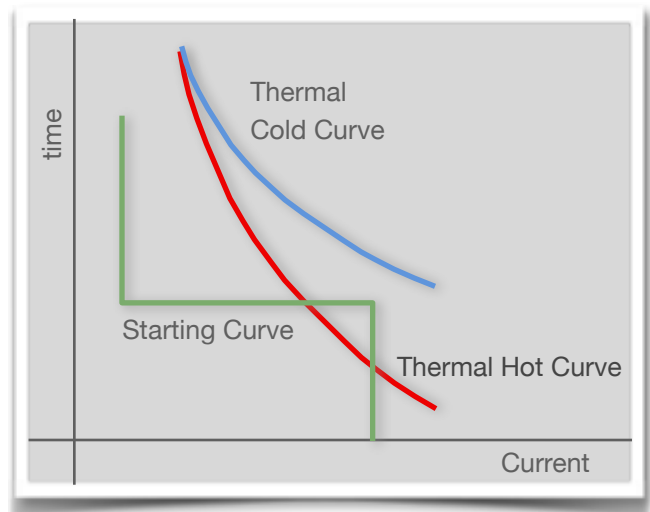
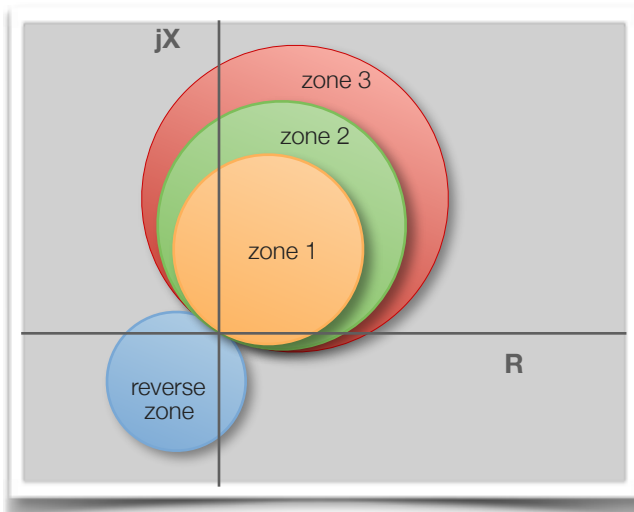
- Generator short-circuit calculation
- Principles of generator protection
- Application of generator protection to different types of generators including embedded generators
- Generator protection relay setting calculation procedure and tutorial
- Instrument transformer requirements and location for generator protection systems
- Testing and commissioning of generator protection systems

OBJECTIVES

This course is designed to help electrical engineers to design and apply protection systems for all types of generators. Participants of this course will gain knowledge to select the list of protection required for all types of generators, calculate the settings to be adopted, specify the correct instrument transformer class and rating. The course will also provide them with knowledge required to test & commission generator protection systems.

Course details

advanced power system protection training



Advanced Line Protection (ALP) - 3 days

CONTENTS

- Transmission line impedance calculation
- Distance protection principles, schemes and application
- Line differential protection principles and application
- Principle and application of phase and directional comparison protection
- Protection of series compensated lines
- Setting calculation procedures and tutorial
- Instrument transformer requirements
- Testing and commissioning of line protection systems

OBJECTIVES

This course is designed to help electrical engineers to design and apply protection systems for transmission lines. Participants of this course will gain knowledge to select the appropriate protection required for lines, calculate the settings to be adopted and specify the correct instrument transformer class and rating.

Advanced Motor Protection (AMP) - 2 days

CONTENTS

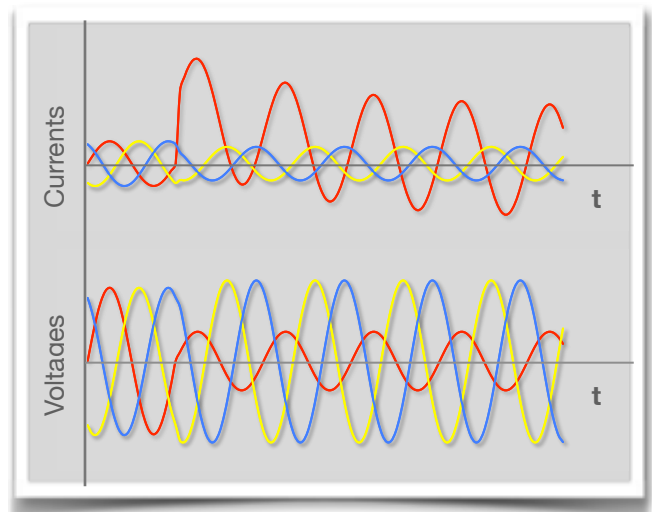
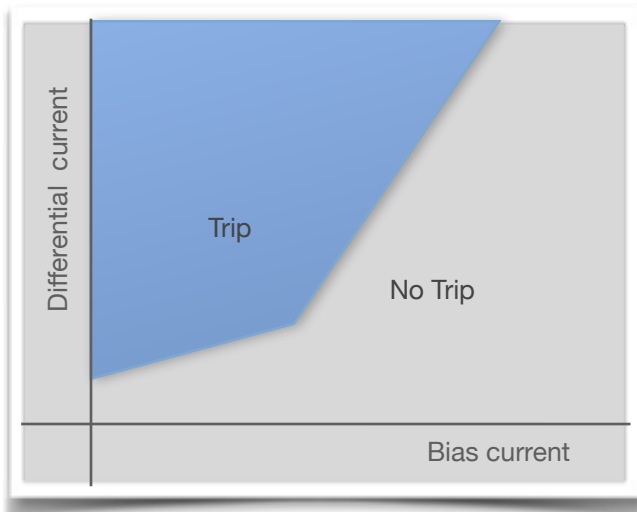
- Introduction to motor operation and characteristics
- Theory and application of induction and synchronous motor protection
- Motor protection setting calculation and tutorial
- Instrument transformer requirements
- Testing and commissioning of motor protection systems

OBJECTIVES

This course is designed to help electrical engineers to design and apply protection systems for all types of induction and synchronous motors. Participants of this course will gain knowledge on the operating characteristics of motors, selection of protections required for all types of motors, calculate the settings to be adopted and specify the correct instrument transformer class and rating. The course will also provide them with knowledge required to find solutions for challenging situations in the field.

Course details

advanced power system protection training



Advanced Transformer Protection (ATP) - 2 days

CONTENTS

- Introduction to transformer operation
- Transformer equivalent circuits and fault calculation
- Theory and application of transformer protection
- Tap changers and automatic voltage regulators
- Transformer protection setting calculation procedure and tutorial
- Instrument transformer requirements
- Testing and commissioning of transformer protection systems

OBJECTIVES

This course is designed to help electrical engineers to design and apply protection systems for all types of transformers. Participants of this course will gain knowledge on the operating principles of transformers, selection of the appropriate protections required for transformers, and calculate the settings to be adopted. They will also learn to test & commission transformer protection systems.

Advanced Fault Analysis (AFA) - 3 days

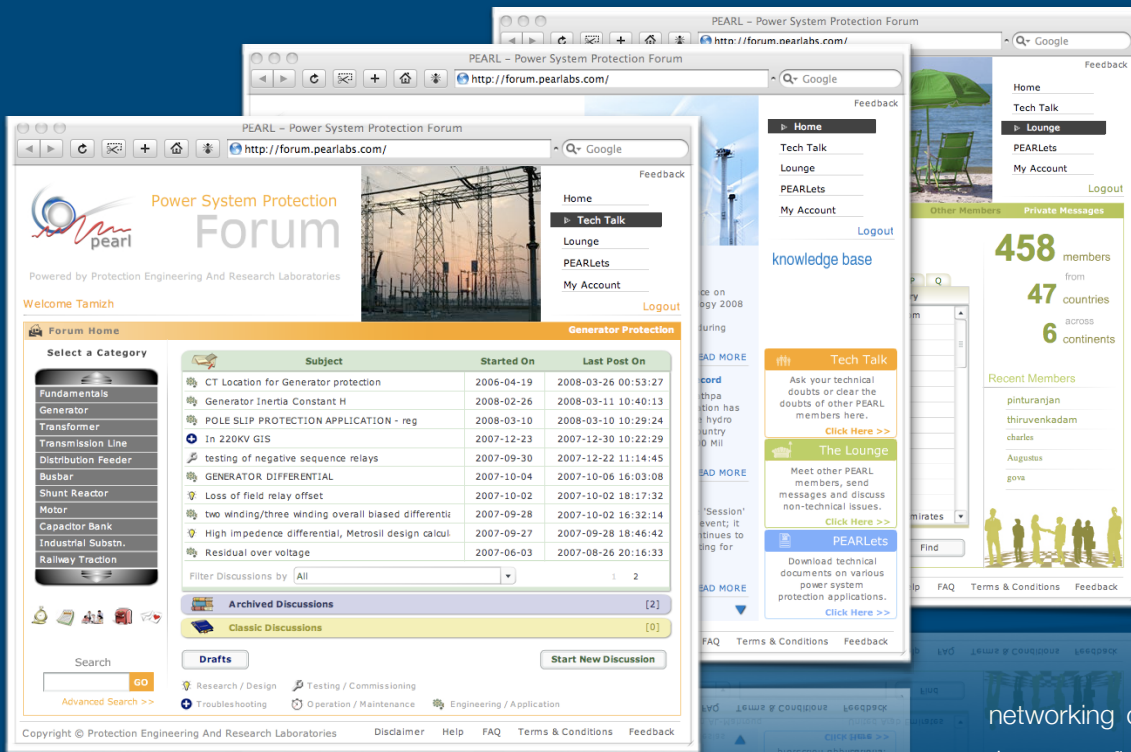
CONTENTS

- Steady state fault calculation procedure
- Equivalent circuits of various plant equipments
- Introduction to post fault analysis tools & techniques
- Fault calculation tutorial
- COMTRADE standard and file interpretation
- Post fault analysis procedure and tutorial

OBJECTIVES

This course is designed to help electrical engineers to do steady-state power system fault calculations and perform post fault analysis. Participants of this course will gain knowledge on tools and techniques required to do steady state fault analysis. This course will also provide them with knowledge required to analyze fault incidents using fault and disturbance records provided by numerical relays. This course will also include case studies of post fault analysis using COMTRADE files of real field events.

the PEARL Protection forum



PEARL hosts an online technical discussion forum for Power System Protection professionals. Any interested person can join the forum by registering online.

This Forum provides an easy medium to discuss technical issues and share knowledge. It also enables easy

networking of professionals working in the same field across the globe. With

members from countries around the world, this FORUM represents a true GLOBAL community of Power System Protection Professionals.

PEARL is committed to creating interest & motivating young engineers to choose a career in the field of protection and automation. We at PEARL strongly believe that "Knowledge Shared is Knowledge Gained" and bring this forum to all people including practicing professionals, academic faculties, students and researchers, free of cost. You can join this global community of Power System Protection professionals by signing in at <http://forum.pearlabs.com>.

Contact Us

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