AbarSolutions
Petroleum Consultancy

Training Course :

Modern Power System Protective Relaying

Training Course For One Week In

Lebanon, Beirut, Crowne Plaza Hamra Beirut Hotel

Which Be Held As Under Details :

Tel. : 00965 22610021 – 99600277 , Fax : 00965 22630021
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Abar Solutions Petroleum Consultancy & Training Qualified From KPC Training & Consulting Services Provider

Abar Solutions Petroleum Consultancy Invite Your Employee To Participate With Us In Special Training Course As Under Details:

Course Name	Modern Power System Protective Relaying					
Code	**Period**	**Language**	**Start**	**End**	**Location**	**Fees**
EL 13	5 Days	Bilingual (Arabic & English)	18/09/2016	22/09/2016	Lebanon, Beirut, Crowne Plaza Hamra Beirut Hotel	1750 KD (15% For Individual Registration) & (25% For Group Registration)
			16/10/2016	20/10/2016		
			13/11/2016	17/11/2016		
			18/12/2016	22/12/2016		
			15/01/2017	19/01/2017		
			19/02/2017	23/02/2017		
			19/03/2017	23/03/2017		
			16/04/2017	20/04/2017		
			14/05/2017	18/05/2017		
			18/06/2017	22/06/2017		
			16/07/2017	20/07/2017		
			20/08/2017	24/08/2017		
** The Fees Includes : Lecturer , Training Material , Training Room With One Coffee Break Daily , Certificate Of Attendance In Last Day Training Course **						

Course Description

⇒ Protection systems are installed to prevent faults from damaging electrical plant and to initiate isolation of faulted sections in order to maintain continuity of supply elsewhere on the system , Recent changes in technology together with changes in the manner in which Utilities and Industrial organisations operate , has greatly emphasised the development of integrated protection and control , Modern relays include facilities such as monitoring and recording capabilities , self diagnostics and permit adjustment of setting by remote control , In short , the role of the modern protection relay is primarily to act in a fault situation but increasingly finds application in transmitting information in connection with the operation of the system , It is however the relay response to fault situations that forms the principal thrust of the current course , This course will cover :

- Power System Fault Analysis
- Transducers and Over current Protection

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- Earth Fault and Transformer Protection - Generator and Motor Protection
- Busbar and Pilot Wire Protection

Course Objective

⇒ Participants will gain a detailed appreciation of the following :

- The nature of different types of electrical faults and the effect these faults can have on company assets
- Understanding of electrical fault protection systems
- Practical solutions for specifying and operating protection systems
- Comprehensive understanding of principles and selection of protection relays and protection schemes
- The requirement for testing of relays and protection systems

Who Should Attend ?

⇒ Engineers and Senior Technicians from Electrical Utilization Companies and Industrial organisations , Building and Services Professionals , who have to deal with the aspects of electrical and industrial power systems protection , control and operation will also find the course beneficial , Participants need no specific requirements other than good understanding of electro technology and some relevant experience

Course Content & Outlines

⇒ Power System Fault Analysis

- Types of fault - Factors affecting fault severity
- Methods of fault calculation - Balanced faults
- Fault calculation procedure - Component representation
- Unbalanced faults - Symmetrical components
- Three-phase faults - Single-phase-earth faults
- More involved circuits and sequence diagrams - Phase to phase faults
- Phase-phase-ground faults - Practical fault studies

⇒ Introduction to Protection

- Basic Objectives and Requirements - Unit and Non-Unit Schemes

⇒ Transducers

- Current and voltage transformers - General current transformer theory
- Current transformer characteristics - Ratio error
- Phase error - Short time factor
- Accuracy limit factor - Specification of current transformers
- Secondary rating - Secondary winding impedance
- Primary windings & Calculation of CT accuracy using CT excitation curve
- Example - Secondary current flow
- Current transformer response to system transients & Harmonics during transients
- Voltage transformers - Residual connection

⇒ Over current Protection

- Relays & The calculation of graded time settings for IDMT relays
- Co-ordination introduction - Co-ordination fundamentals
- Settings - Discrimination period overall time interval
- Simple grading example - Definite time over current relays
- Systems incorporating various voltage levels & Directional over current systems
- High set over current relays - Problem of overreach
- Low voltage industrial system protection - MCCBs and ACBs
- Microprocessor based MCCBs

⇒ Earth Fault Protection

- Sensitive earth fault relays - CT burdens for various fault types
- Equivalent circuit and secondary current flow & Neutral earthing
- Example - Directional earth fault relays
- Interlocked over current - Typical modular over current protection
- Multifunctional features and applications of modern microprocessor based over current relays

- Typical relay data
- Applications
- Modular relays
- Fuses
- Appendix A: Relay characteristic curves

⇒ Transformer Protection

- Failure and their causes
- Current flows in transformers due to symmetrical and unsymmetrical faults
- Differential protection
- Tutorial
- Biased systems
- Earth fault protection
- Restricted earth fault protection
- Other fault types
- Fault withstand levels
- Review of additional protection & Protective schemes for various types transformer
- Integrated multi-microprocessor overall protection
- Transformer feeders
- Small transformers
- Interposing current transformers
- Neutral earthing transformer
- High impedance schemes
- Current transformer ratios & connections
- Level of fault current
- Externally applied conditions
- Magnetising inrush
- Tripping schematics

⇒ Generator Protection

- Introduction & Generator operating under fault conditions
- Steady-state calculations
- High impedance earthing
- Generator transformers
- Generator unit protection excluding differential protection & Overcurrent protection
- Unbalanced load and negative sequence protection & Asynchronous running
- Balanced earth fault and neutral displacement & Stator earth faults
- Over-excitation protection
- Overvoltage protection
- Shaft current protection
- Generator earthing
- Differential protection
- High impedance differential
- Reverse power protection
- Underfrequency protection
- Rotor ground fault protection

- Typical protection used for generators of various ratings

⇒ Motor Protection

- Induction motor protection - Protection requirements
- Thermal considerations - General considerations
- Stalling of motors - Too many starts
- Operation of three-phase induction motors on unbalanced supply voltage
- Equivalent circuits of motor - Single phasing
- Electrical faults in stator and rotor windings
- Short circuits between phases (internal to motor) - Relay to be considered
- Short circuit to earth & Undercurrent, underpower, undervoltage
- Differential protection - Undervoltage during running
- Undervoltage at start-up - Additional protection (synchronous motors)
- Example of multifunctional relay - Protection co-ordination with system

⇒ Further Examples of Differential Protection

⇒ Busbar Protection

- Stability & Differential protection using high impedance relays
- Settings & Typical calculation for high impedance scheme
- Location of current transformers - Peak voltage across CTs
- Frame-earth protection

⇒ Pilot Wire Protection

- Practical Pilot Wire Schemes

⇒ Basic Principles of Distance Protection

- General - Distance relay zones
- Performance requirements of power system
- Source impedance ratio and relay voltage correlation
- Example - Relays
- Relay schemes - Miscellaneous problems