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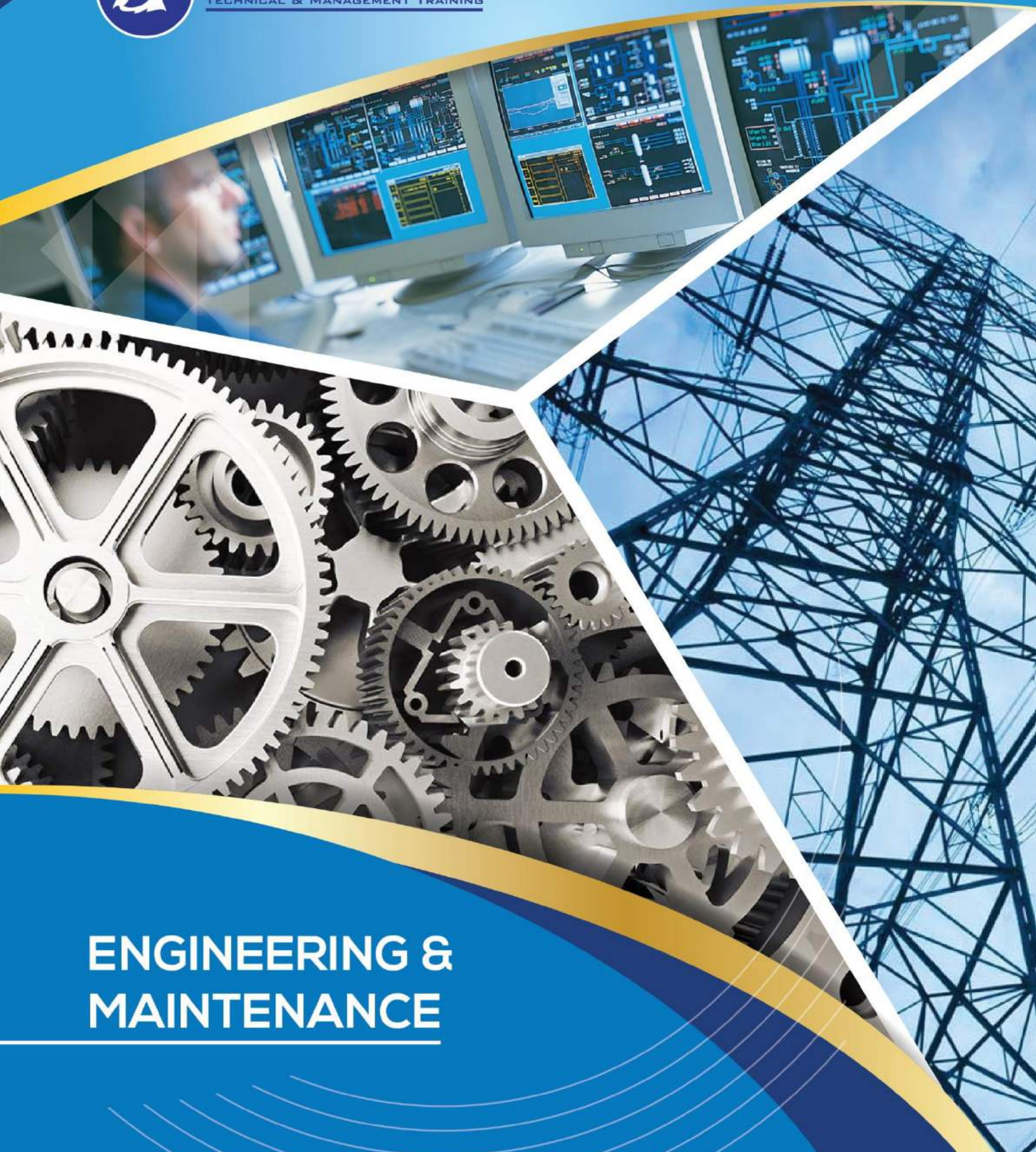

ENGINEERING & MAINTENANCE

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ELECTRICAL PROGRAMS

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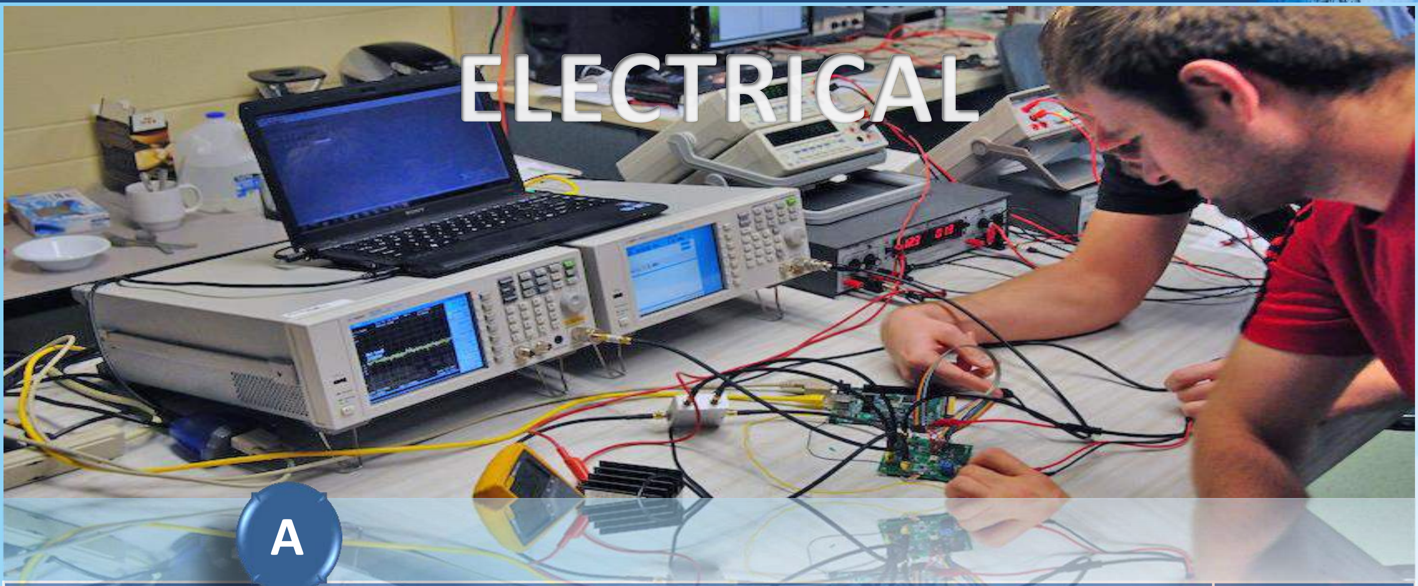


A

NO/CODE	COURSE TITLE	COURSE DURATION
UETMT - ELEC- 101	CAPACITORS IN DISTRIBUTION SYSTEM	5 days
UETMT - ELEC- 102	HIGH VOLTAGE & MEDIUM VOLTAGE SWITCHGEARS & CIRCUIT BREAKERS	5 days
UETMT - ELEC- 103	HV CABLE JOINTER CERTIFICATION	5 days
UETMT - ELEC- 104	TRANSFORMER MAINTENANCE & TROUBLESHOOTING	5 days
UETMT - ELEC- 105	ELECTRICAL CONTROL AND DRAWINGS	5 days
UETMT - ELEC- 106	ELECTRICAL SWITCHGEAR FOR ENGINEERS	5 days
UETMT - ELEC- 107	EARTHING SYSTEM AND LIGHTNING PROTECTION	5 days
UETMT - ELEC- 108	ADVANCED CONTROL SYSTEMS	5 days
UETMT - ELEC- 109	EMERGENCY DIESEL GENERATOR OPERATION	5 days
UETMT - ELEC- 110	ADVANCED ELECTRICAL EQUIPMENT: TROUBLESHOOTING AND MAINTENANCE	5 days
UETMT - ELEC- 111	EMERGENCY DIESEL GENERATOR	5 days
UETMT - ELEC- 112	ELECTRICAL INSPECTION AND TESTING	5 days
UETMT - ELEC- 113	DIESEL POWER PLANT OPERATION & MAINTENANCE	5 days
UETMT - ELEC- 114	CABLES: SELECTION, TESTING, SPLICING & INSTALLING	5 days
UETMT - ELEC- 115	ELECT SAFETY, LOCKOUT, TAGOUT, HAZARD AREA CLASSIFICATION, ELECT STANDARDS AND REG	5 days
UETMT - ELEC- 116	ELECTRICAL LOAD FORECASTING	5 days
UETMT - ELEC- 117	ELECTRICAL INSTALLATIONS & MAINTENANCE	5 days
UETMT - ELEC- 118	CIRCUIT BREAKER CONTROL	5 days
UETMT - ELEC- 119	CONTROL CIRCUITS	5 days
UETMT - ELEC- 120	BASIC ENGINEERING DRAWING	5 days

NO/CODE	COURSE TITLE	COURSE DURATION
UETMT - ELEC- 121	13.8 KV GENERATOR CONSTRUCTION, OPERATION, PROTECTION, VOLTAGE REGULATION, TESTING AND MAINTENANCE	5 days
UETMT - ELEC- 122	ELECTRICAL POWER SUBSTATION MAINTENANCE	5 days
UETMT - ELEC- 123	ELECTRICAL GENERATOR & POWER TRANSFORMERS	5 days
UETMT - ELEC- 124	ELECTRIC POWER GENERATION, TRANSMISSION AND PLANNING	5 days
UETMT - ELEC- 125	ELECTRICAL PREVENTIVE MAINTENANCE	5 days
UETMT - ELEC- 126	ELECTRICAL DISTRIBUTION SYSTEM EQUIPMENT - PREVENTIVE MAINTENANCE	5 days
UETMT - ELEC- 127	INTRODUCTION TO EXCITER / AUTOMATIC VOLTAGE REGULATOR (AVR)	5 days
UETMT - ELEC- 128	INVENTORY OF ELECTRIC AND MECHANICAL EQUIPMENT	5 days
UETMT - ELEC- 129	BATTERY, BATTERY CHARGERS & UPS	5 days
UETMT - ELEC- 130	DESIGN REPAIR, MAINTENANCE, SETTING, CALIBRATION AND TESTING OF VARIOUS PROTECTION RELAYS	10 days
UETMT - ELEC- 131	OPERATION & MAINTENANCE OF PROTECTION RELAY	5 days
UETMT - ELEC- 132	ELECTRICAL ENGINEERING PRACTICES FOR SURFACE FACILITIES	5 days
UETMT - ELEC- 133	ELECTRICAL DISTRIBUTION SYSTEMS: OPERATION, TESTING & PROTECTION	5 days
UETMT - ELEC- 134	ELECTRICAL EQUIPMENT IN HAZARDOUS AREAS AND CLASSIFICATION	5 days
UETMT - ELEC- 135	ELECTRICAL SAFETY CODES	5 days

CAPACITORS IN DISTRIBUTION SYSTEM

UETMT- ELEC- 101

Program Duration: 5 days

PROGRAM OBJECTIVES

The objectives of the program of Capacitors in Distribution System include the desire to acquaint electric power engineers and qualified technicians with Capacitors in Distribution System to correct power factor and its importance in distribution to reduce line losses and to attain certain voltage profile. The reactive power control is also the main desire of this short program as well as the voltage control. This includes a functional description of the distribution system, control, maintenance, and protection as well as the routine maintenance requirements of the distribution lines and underground cable. The program will include another objective for power factor improvement which is the minimization of losses or loss reduction distribution system.

TARGET AUDIENCE

All Engineers and technicians involved in the power sectors and power station operation and maintenance, and also in the factories, and enterprises, especially in distribution system.

TARGET COMPETENCIES

- Capacitors in Distribution System
- Overhead Transmission Line
- Underground and Cables

PROGRAM CONTENT

Introduction:

- General Background.
- Power factor concept.
- Reactive power regulating devices.
- Generator exciter – capacitors – reactors – static VAR compensators.
- Shunt capacitors and their location and size to reduce losses in distribution.

Representation of Individual Power System Components:

- The Overhead Transmission Line.
- Evaluation of Transmission Line Parameters.
- Underground and Cables.
- Shunt Elements.
- Series Elements.
- On load tap changing transformers.
- Power factor improvement of resistance welders.
- Power factor improvement of arc welding transformers.
- Power factor improvement for induction furnaces.

Power Factor Test:

- The meaning of reactive power and active power.
- The meaning of compensation of reactive power, why is it necessary?
- The difference between shunt compensation and series compensation.
- The application of shunt capacitors and series capacitors.
- Shunt capacitors and shunt reactors.
- The optimum location and size used in power system.
- At what voltage levels are the shunt capacitors installed.
- Standard rating of capacitor units and capacitor banks.
- The methods of voltage-control in power systems.
- Economic of power capacitors.
- Synchronous condenser and static shunt compensator.
- Effect of reactive power flow on voltages

Harmonics and Source of Harmonics:

- Diodes – Thyristors – Transformers.
- Elimination of harmonics.
- Filters, harmonic suppression.
- Star – Delta transformers.
- Problem caused by harmonics.
- Individual compensation.

Power Factor Correction Calculation Example

- Measurement of power factor.
- The effect of shunt capacitors in distribution systems.
- Computer Results for sample networks.
- Selection of capacitor size and location to reduce distribution losses.
- Selection of standard capacitor units and capacitor bank.
- Rating of power capacitors.
- Saving in electrical energy and economic aspects in using shunt capacitors.

Design of an Automatic Power factor Improvement Unit

Protective Relays and Protective Schemes:

- Introduction
- Protective Schemes.
- Low-voltage Protection.
- Performance Check of Protective Relays and Measuring Equipment.
- Capacitor Protection
- Protection against Resonance.

Earthing and Bonding:

- Disadvantages of Ungrounded Systems.
- Types of Grounding.
- Earthing Transformers, Current Transformers, and Voltage Transformers.
- Safety Grounding

Seminar-Case Study-Discussion-Evaluation

HIGH VOLTAGE & MEDIUM VOLTAGE SWITCHGEARS & CIRCUIT BREAKERS

UETMT- ELEC- 102

Program Duration: 5 days

PROGRAM OVERVIEW

Switchgear plays an important role in the safe and reliable distribution of electrical power. Failure to quickly and efficiently disconnect faults downstream in the network, or a failure within the switchgear itself is costly, resulting in loss of supply, damage to equipment and possible injury, to personnel.

It is therefore important that switchgear is selected, installed, operated and maintained correctly, embracing an overall ass et management regime that is both economic and effective in securing a high level of system reliability.

This course focuses mainly on medium voltage switchgear associated with power distribution in industrial systems, which comprises by far the bulk of switchgear on most electricity distribution systems. The emphasis is primarily on air-break, SF6 and vacuum circuit breakers, but other forms of MV switchgear, for example ring main units and auto re-closers will also be discussed. Gas insulated equipment, (GIS), for higher voltages will be discussed in some detail.

PROGRAM OBJECTIVES

Delegates will gain a detailed appreciation of the following:

- Types and rating of switchgear - substation layouts and design - indoor and outdoor
- Switchgear components CT's, VT's, protection relays and cable terminations
- Calculation of fault levels
- Basic earth fault, unit and overload protection schemes
- Safe operational policies, including safety rules and safety documents
- Asset management of equipment
- Diagnostic tools - insulation testing, partial discharge testing, thermal imaging and potential test equipment.
- Make and break testing of trip and contact systems test equipment
- Safe maintenance policies, including safe working practice in switch rooms, indoor and outdoor substations
- National fault reporting schemes
- Earthing

TARGET COMPETENCIES

- Types of Switchgear
- Earth Fault
- Overload Protection Schemes
- Arc Characteristics
- Switchgear Ancillaries
- Insulation Resistance Testing

PROGRAM CONTENT

Day 1: Introduction to Switchgear

- Goals of the course – discussion to determine background of participants
- Evaluation questionnaire – to be completed by participants
- Single line diagrams – what is a power network? Why different voltage levels?
- Network components – active and passive –
- Typical examples
- Simple busbar and substation layouts –
- Layouts – protection and control circuits
- Fault Levels - MVA rating of equipment – 1 and 3 second rating
- Measuring transformers VT's and CT's
- Circuit breaker utilization, dis connector operation and earthing switches
- Fuses-LV and HV fuses. Fuse gear. Video of short circuit testing
- Air break switches – arc chutes and magnet effects.
- MCC's for LV distribution boards.
- Contactors for motor switching.
- Balanced and earth faults - network and busbar faults
- Basic system earthing requirements – why earth?
- Rating of switchgear – normal and fault duties – control and monitoring circuits
- Selection and checking for correct switchgear ratings - LV, MV, HV and EHV
- Basic protection relays for unit, overload and earth faults. Back up protection
- Case study including safety considerations.
- Effects of loads on switching
- Energizing and de-energizing transients that can affect the network insulation
- Worked example of substation fault level and circuit breaker selection for a small petro-chemical installation
- Wrap up session – what have we achieved today?

Day 2: Distribution Switchgear

- Primary substations – name plate data
- Device function numbers – suffix letters, main devices and auxiliary devices
- Vacuum Switchgear up to 36kV
- Description of equipment – front, rear, cable entry and busbars
- Vacuum principles of interruption
- Air and SF6 external insulation of busbars and vacuum interrupters
- Voltage withstand levels, 50Hz and lightning impulse
- HV fuses in combination with, and as an alternative to circuit breakers
- Oil breakers – do you have these breakers on your system? Discuss!
- Maintenance requirements air, oil, vacuum and

HIGH VOLTAGE & MEDIUM VOLTAGE SWITCHGEARS & CIRCUIT BREAKERS (Cont.)

UETMT- ELEC- 102

Program Duration: 5 days

- SF6 – identify procedures
- Secondary substations – name plate data –
- indoor/outdoor equipment
- Auto-reclosing equipment-dis connectors
- Typical layouts and selection of equipment
- Modern SF6 Distribution Switchgear
- SF6 principles of interruption and insulation –
- video covering vacuum and SF6
- Puffer operation and rotating arc breakers
- Contacts – vacuum and SF6 -measurement of wear and contact resistance
- Rotating arc concept
- Gas Insulate Switchgear, SF6 -what are the maintenance problems?
- Single phase and Trefoil arrangements for busbars
- Maintenance and testing requirements for vacuum and SF6
- Operational arrangements for a range of typical
- breakers up to 45kV
- Wrap up session - SF6 -v-vacuum delegate discussion – practical issues!

Day 3 : Switching, Safety and Earthing Requirements

- Busbar configurations – single, double, sectionalized and breaker and a half
- Main substation earthing and bonding for 50Hz
- Step and touch potentials – danger to personnel
- Routine testing and certification of substation earthing
- Interrupter classification-mechanisms, motor-spring, hydraulic and solenoid
- Switching Requirements –interrupting time, sym/ asymmetric waveforms
- Surge arrestors for lightning protection - ratings
- Auto-reclosing considerations – ring main and radial circuits
- Safe working in a substation environment
- Mechanisms of deterioration in insulation - water, mechanical vermin, human
- General safety precautions and the use of personal protective equipment
- Principles of safety rules and safety policy –personal authorization?
- Operative training for safe operation of switchgear – isolation of breaker
- Safety documentation and safety interlocks key/padlock procedures
- Operational and safety locking, caution and danger notices
- Substation alarms
- Using drawings and manufacturers literature identify suitable layouts then:
- Example - team exercises using above information

Day 4: HV Gas Insulated Switchgear and Auxiliary Plant Maintenance

- 145kV, 3 phase arrangement and single 275/400kV SF6 arrangements
- Arc characteristics – closing and opening – short circuit testing - standards
- Switchgear ancillaries, measurement CTs, VTs, relays –complex protection
- SF6 parameters - filling pressures and dew point considerations - hazards?
- Decomposition of arced SF6.
- Handling contaminated materials – disposal!
- Inspection and routine maintenance –earthing for safe working! Gas carts
- Equipment required for maintenance –investigating leaks
- Insulation resistance testing
- Mechanism testing and auxiliary relay contact circuits –trip coils open/close
- Contact trip timing tests and record interpretation – contact resistance tests
- Testing of MV and HV Switchgear-partial discharge diagnostic tests
- Thermal imaging – simple and complex
- Power Factor tests – voltage pressure tests AC, DC!
- Fault recording and reporting –national data base of faults
- Maintenance records
- Health and Safety
- Test: Write down routine tests required for the various types of switchgear.
- How often should they be performed? What is the short circuit rating of equipment? How do you go about carrying out a switching operation?
- Wrap up session - discuss your own experience of maintenance policies

Day 5: Maintenance and Testing

- Switchgear defects and defect control systems
- Health and Safety in Substations
- Mechanisms of deterioration of insulation
- MCC testing and refurbishment - contacts and arc chutes
- Troubleshooting – use of diagrams and manufacturers manuals
- Block diagrams, line diagrams, wiring diagrams, interlock diagrams
- Required maintenance – condition, heaters, fuses, mechanism, overhaul
- Weekly, monthly, yearly program of maintenance – 5 years and more?
- Principles of circuit breaker maintenance –mechanisms and mechanical aspects
- Maintaining vacuum circuit breakers –equipment required
- Maintaining SF6 circuit breakers –equipment required SAFETY!
- Protection unit and busbar
- Relay testing – time/current test, pick up current, zero checks, drop out
- CT and VT check
- Case histories of failures – how to investigate and report
- Asset management - refurbish or replace?
- Discussion time
- Wrap up session - Have we got there?
- It is intended to use several design examples to illustrate the points being made in the main material.
- Numerous types of breakers will be referred to from a range of manufacturers.

HV CABLE JOINTER CERTIFICATION

UETMT- ELEC- 103

Program Duration: 5 days

PROGRAM OBJECTIVE

By the end of the program, the participants will be able to:

- Demonstrate the Construction of Cables
- Know How to make a H.V Terminals and Joints
- Simply Calculate a Voltage Drop
- Carry Out Maintenance and Testing for Power Cables

PROGRAM COMPETENCIES

- Electrical Conductors
- Cables, Cable Ampacities and Voltage Drop Cables
- High Voltage Cables

PROGRAM CONTENTS

ELECTRICAL CONDUCTORS

- Conductor Materials
- Wire Measurements, U.S. Customary System
- The American Wire Gauge
- Wire Measurements, SI Units
- Stranded Wire
- Resistively
- Temperature Coefficient of Resistance

PROPERTIES OF CONDUCTORS

- Electrical Wire and Cable Terminology
- Classification of Wires or Cables
- Classification according to Degree of Covering
- Material and Make-up of Electrical Conductors
- Cable Assembly
- Electrical Shielding
- Fillers
- Binder Tapes
- Insulation of Electrical Conductors
- Rubber Insulation
- Code-grade Rubber Compound
- Thermoplastic Insulation
- Thermosetting Insulation
- Mineral Insulation
- Paper Insulation
- Protective covering Materials
- A Pure Lead Sheath
- A Reinforced Lead Sheath
- An alloy Lead Sheath
- Flat band Armour
- Interlocked Armour
- Wire Armour
- Basket Weave Armour
- MI (mineral insulated) Cable

CABLES, CABLE AMPACITIES AND VOLTAGE DROP CABLES

- General
- Power Cables
- General Construction
- Conductors
- Insulation, Covering and Stress Relief
- Cable Stress Relief
- Bedding
- Armouring
- Outer Sheath
- Selection of Power Cables
- Control Cables
- Mineral Insulated Cables
- Method of Specifying Cables

HIGH VOLTAGE CABLES

- Cables Construction
- Strand Shielding
- Insulation
- Insulation Shielding
- Cable Jacket
- Cable Termination
- Cable Termination Design
- Conductor Ampacities
- Voltage Drop
- Voltage Drop Tables
- Calculations
- Voltage Drop Considerations
- Recommended Limits of Voltage Variation

CABLES JOINTS AND TERMINAL CONNECTIONS

Cables Joints and Connections

- Protection of Joints
- Removing Protective Covering
- Removing Insulation
- Cleaning Wire Ends
- Straight Splice for three conductor unshielded cable.
- Straight Splice for three conductor shielded cable
- Scotch Cast in Line Joint

Terminating Power Cables

- General Instructions
- Termination for unscreened three-core plastic and rubber insulated cables

Wire Connectors

- Solder less Connectors
- Screw on Pigtail Connectors
- Bolted Type Pressure Connectors
- Run and Tap Connectors
- Bolted Type Lugs
- Terminal Blocks
- Compression Type Connectors and Lugs
- Connector Designation and Marking

POWER CABLES MAINTENANCE AND TESTING

MAINTENANCE

- Visual Inspection
- Manhole Installations
- Aerial Installations
- Raceway and Cable Tray Installations
- Remedy of Mechanical Problems
- Remedy of Overheating Problems
- Portable Cable Maintenance

TESTING

- Insulation Resistance Test (Meggering)
- D.C over-Potential Test (Hi-pot)

TRANSFORMER MAINTENANCE & TROUBLESHOOTING

UETMT- ELEC- 104

Program Duration: 5 days

PROGRAM DESCRIPTION:

This training program is designed to provide an understanding of the basic fundamentals and constructional features of Power Transformers with particular reference to the Transformer Principles, Design, Testing, Operation and Maintenance of Transformers in Power Systems.

PROGRAM OBJECTIVES:

By the end of the program, participants will gain a full scale understanding of the following:

- Identify the different features of Power Transformers, Distribution Transformers and Instrument Transformers
- Appreciate the principles of Transformer Design, Ratings, windings, core structure and materials, insulation and cooling methods, insulation and lifetime
- Be familiar with construction of the Transformer, Transformer Winding connections
- Recognize the effects of Transformer load changes and off-load and on-load tap changers
- Utilize Thermal limits and loading guides of Transformers.
- Analyze Transformer failure modes
- Perform Transformer Maintenance and Testing
- Practical solutions for specifying, Operating and Maintaining Power Transformers in a utility or Plant Environment

PROGRAM LEARNING OUTCOMES

- Comprehensive understanding of principles, selection, testing and commissioning, of distribution, and Power Transformers.
- The necessary safe procedures relating to Transformer Operation and related circuitry.
- Practical solutions for specifying, operating and maintaining Power Transformers in a utility or Plant Environment.
- Transformer Electrical Protection and Troubleshooting.
- Testing and Maintenance of Transformers.

DESIGNED FOR:

- Engineers and Technicians who install, maintain, repair or troubleshoot power transformers used in utility and industrial applications.
- Engineering Professionals from companies manufacturing and Operating Power and Distribution Transformers

PROGRAM CONTENT:

Day 1:

Introduction, General Principles and Classification

- Course Pre-assessment
- General Classification of Transformers: Transformer Construction, Core-Type, Shell-Type, Dry-type Transformers, Oil-filled Transformers, Cooling Techniques
- Transformer Windings, Interconnection of Windings, Advantages and Disadvantages of Principal Connections.
- Harmonics in Transformers, Parallel Operation of Transformers, Loadings of Transformers in Parallel, Paralleling Requirements, Polarity
- Standards for Transformers, Types and Requirements
- Transformer Tapings and Connections
- Ability to withstand Short Circuit, Sound Level
- Case Studies and Workshop Discussion
- Day 1 Quiz

Day 2:

Transformer Constructional Details

- Transformer Oil, Characteristics, Oil Oxidation, Breakdown Voltage, Water Content, Acidity, Oil Testing, Field Oil Testing, Dissolved Gas Analysis, Treatment and Filtering of Oil
- Effect of Oil Expansion, Breathing Action, Buchholz Relay, Explosion Vents.
- Instrument Transformers
- Transformers for Industrial Applications: Electro-chemical, Arc and Induction Furnaces, Rectifier Transformers, High Voltage Testing Transformers, Auto Transformers, Dry Type Transformers
- Construction and Details, Transformer Cooling, Natural Cooling, Forced Cooling.
- Workshop Discussion
- Day 2 Quiz

Day 3:

Transformer Features and Thermal Performance

- Thermal performance and Cyclic Rating of Transformers. Temperature indicators and alarms.
- Transformer Impedance, Electromagnetic Forces
- Transformer Construction: Cores, Assembly
- Transformer Windings Construction: Coil Types, Disc Coils, Cross-over Coils, Concentric Coils, Sandwich Coils, Transpositions
- Transformer Tanks and Radiators, Tank Losses, Paint Treatments
- Transformer Fittings: Lifting Lugs, Undercarriages, Jacking Pads, Tie-Down Lugs, Bleed Pipes, Thermometers
- Workshop Discussion
- Day 3 Quiz

Day 4:

Transformer Operation and Maintenance

- Distribution Voltage Adjustment, Off-Load Tap Changing, On-Load Tap Changing.
- Switching of high voltage underground cables supplying Distribution Transformers
- Earthing and Over-Current Protection of Distribution Transformers
- Transformer Maintenance: Oil preservation , Deterioration of oil, Breathers, Condition Monitoring, Faults in Transformers, Tapings and Windings
- Advanced Transformer Maintenance
- Guidelines on how to care for your Distribution Transformer
- Case studies and Workshop Discussion
- Workshop Discussion
- Day 4 Quiz

Day 5:

Transformer Testing

- Transformer Routine Tests
- Measurement of winding resistance
- Measurement of voltage ratio
- Measurement of impedance voltage short-circuit impedance and load loss
- Measurement of No-load loss and current
- Insulation resistance
- Harmonics testing
- Separate-source power-frequency voltage withstand test
- Induced over-voltage withstand test
- Transformer Type Tests
- Temperature–rise test
- Lightning impulse test
- Sound level
- Special Tests: Transformer Partial Discharge testing
- Workshop Discussion
- Day 5 Quiz
- Course Post-assessment

ELECTRICAL CONTROL AND DRAWINGS

UETMT- ELEC- 105

Program Duration: 5 days

PROGRAM DESCRIPTION

- This highly relevant seminar is intended for electrical engineers and technicians involved in electrical control and control drawings. And those are responsible for electrical designee and revising electrical drawings.
- The program can be used as an introduction to the field of Instrumentation and Control for those who are interested to work in this area.

PROGRAM OBJECTIVES

The program presents a systematic approach to the basics of electrical control. It first adopts a general approach to the main control elements, the method of primary control. Then it explains what is meant by open loop and closed loop systems. PLC construction, operation, different types, and its use in different electrical utilities is presented with many applications. The power Circuit drawings and its associated control circuit drawings will be deeply involved in this program with some applications in industry.

Upon completion of this program, participants will gain an understanding of basic electrical control and its applications. Also they will be aware of PLCs and its application in electrical utilities and different aspects of industry. They will also gain some knowledge of how to reinstall simple control circuits. The attendance will be familiar with most of the electrical and mechanical drawings in most of their work sheets and maps.

TARGET AUDIENCE

- Electrical Engineers
- Senior technicians who work in the electrical control and power utilities.
- Technicians who would like to refresh their knowledge.
- Mechanical and chemical Engineers who are interested in control subjects

TARGET COMPETENCIES

- Electrical Control
- Analog Signal Conditioning
- Valves and Actuators

TRAINING METHODOLOGY

Each program participant will receive a copy of the comprehensive program notes. The presenter will discuss the topics using OHP- Data show. The program is designed to have an interactive format to maximize delegate participation. Questions and answerers are encouraged throughout and at the daily sessions. Needs based case studies and examples will be discussed in problem solving workshops sessions. This gives participants the opportunity to discuss with other delegates and the presenter their specific problems and appropriate solutions.

PROGRAM CONTENT

Introduction

- Definition of control
- Control elements
- Control systems
- Units, Standards, and definitions.

Analog Controllers

- Analog Signal Conditioning
- Valves and Actuators
- Closed Loop and Open Loop Control
- Control Elements

Digital Control

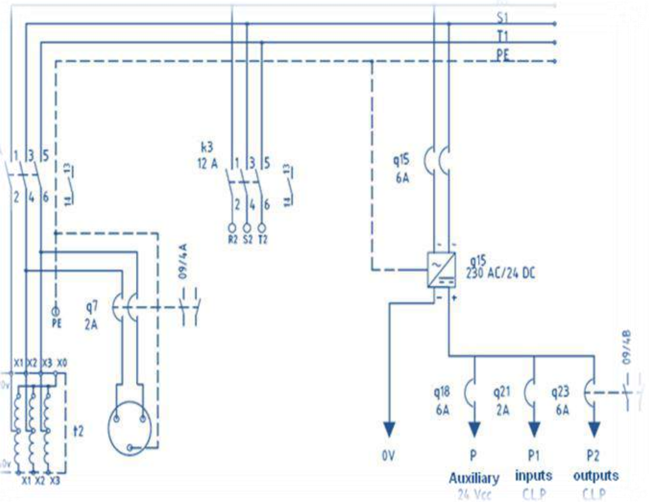
- Data Acquisition Systems
- Data Loggers
- Supervisory Computer Control
- Control Rooms

PLC

- PLCs Construction
- PLCs Functions
- PLCs Circuits
- PLCs Operation and maintenance

Electrical Drawings

- Electrical and Control symbols
- Drawing Charts
- Computer graphics



ELECTRICAL SWITCHGEAR FOR ENGINEERS

UETMT- ELEC- 106

Program Duration: 5 days

PROGRAM DESCRIPTION

This scope includes material that enables attendees to have in-depth understanding of theory of operation of electrical switchgear and essential issues relevant to daily operation and maintenance of motor control centers and low-voltage, medium-voltage and high-voltage switchgear.

TARGET AUDIENCE

- Electrical Engineers
- Senior technicians who work in the electrical control and Power Utilities
- Technicians who would like to refresh their Knowledge
- Mechanical and Chemical Engineers who are interested in Control Subjects

TARGET COMPETENCIES

- Electrical Switchgear
- Switchgear Earthing System

PROGRAM CONTENT

Introduction to Electrical Switchgear:

- General information about switchgear.
- Switchgear use.
- Switchgear requirements.
- Codes and Standards.

Types of Switchgear

- Classification of Switchgear
- Switchgear Construction
- The Switchgear assembly
- Switchgear Enclosures
- Mechanical degree of Protection
- Busbars

Switchgear Earthing System

- Switchgear Earthing Requirements
- Components Earthing

Medium Voltage Circuit Breakers, Fused Contactors and Load Break Switch

- Description for Each Item
- Differences

Switchgear Arc Extinction Media and Theory

- Types of Arc Extinction Media
- Advantages
- Differences

Switchgear Protection and Control

- Switchgear Protection Scheme
- Control requirements

Switchgear Metering

- Metering specifications
- Metering requirements

Current Transformers

- Types
- Accuracy

Potential Transformers

- Types
- Requirements

Factory Acceptance Test (FAT)

- Type test
- Routine tests

Handling and Storage

- Handling procedures
- Storage requirements

Erection

- Safety
- Erection Preparations

Site Acceptance Test (SAT)

- Description
- Requirements

Commissioning and Start-up

- Procedures
- Hand over system

Troubleshooting

EARTHING SYSTEM AND LIGHTNING PROTECTION

UETMT - ELEC- 107

Program Duration: 5 days

PROGRAM OBJECTIVES

This is an Interactive Training Program which is designed to Familiarize Trainees with the Earthing System & Lighting Protection.

By the end of this program, participants will be able to:

- Describe the Purpose of the Earthing
- Describe different Types of the Earthing
- Describe Specific Earthing Application
- Describe System Earthing
- Describe the Connection to Earth

TARGET COMPETENCIES

- Methods of Earthing
- Earth Conductors

PROGRAM CONTENT

Introduction

Standards and Legal Framework

- Philosophy underlying the Standards
- Summary of Contents of Main Standards and Codes of Practice
- Domestic Commercial and Industrial Premises
- High and Medium Voltage Electricity Substations

Methods of Earthing

- Main Power Network
- Unearthed or Insulated System
- Earthed Systems
- Impedance Earthed System
- Low impedance (Solidly) earthed System
- Earthing on LV Systems and Within Premises

Earth Conductors

- Requirements of the Earthing System
- Bonding and Protective Conductors
- Earth Electrodes
- Rods
- Plates
- Horizontal Electrode Derivatives

Case Study 1- Methods of Earthing

A discussion will follow presentations of the Case Study. Participants will be drawn out to take part in the discussion.

Installation Methods

- Rods
- Plates
- Horizontal Electrodes
- Backfill
- Connections
- Mechanical
- Brazed
- Exothermic joints
- Welded
- Fault Current Carrying Capacity
- Testing and Inspection Facilities

Performance of Earth Electrodes

- Effect of Electrode Shape, Size and Position
- Increasing the Buried depth of a Vertical rod in Uniform Soil
- Increasing the Length of a Horizontal Conductor
- Increasing the side length of a Square Earth Grid/Plate
- Increasing the Radius of an Earth Rod
- Buried Depth
- Proximity Effect
- Complex Electrode Arrangements
- Contact Resistance
- Soil Resistivity
- Measurement of Soil Resistivity

Case Study 2 - Measurement of soil Resistivity

A discussion will follow presentations of the Case Study Participants will be drawn out to take part in the discussion.

Design of Earth Electrode Systems

- Small Area Electrode Systems
- Medium Area Electrode Systems
- Sites Requiring more specific Attention
- Communication Facilities
- Surge Diverters
- Reactors and AC to DC Converters
- Co generation Plants
- Capacitor banks/Capacitor Voltage Transformers
- Gas Insulated Switchgear(GIS)
- Fence Earthing
- Independent Fence Earthing
- Fence Connected to the Substation Earthing

Earthing Design within Buildings

- Typical TN-S Arrangements
- Integrated Earthing systems
- Arrangements to reduce interference

Case Study 3 - Design of Earth Electrode Systems

A discussion will follow Presentations of the Case Study. Participants will be drawn out to take part in the discussion.

Lightning Protection

- The Formation of Lightning
- Risk Assessment
- Components of the Lightning Protection System
- Air Terminations
- Down Leads and Bonding Conductors
- Earth Termination
- Surge Protection Devices
- Lightning Protection of Power lines

Electrical Interference

- Resistive Coupling
- Capacitive Coupling
- Inductive Coupling

Measuring the Impedance of Earth Electrode System

- Equipment required
- Safety
- Measurement of Small and Medium Sized Electrodes
- Measurement of Larger Area electrode systems

Case Study 4 - Lightning Protection

A discussion will follow presentations of the case study. Participants will be drawn out to take part in the discussion

Artificial Method of Reducing Earth Resistivity

- Acceptable Low Resistivity Materials
- Bentonite
- Marconite
- Gypsum
- Others
- Unacceptable Backfill Materials

Maintenance of Earthing Systems

- The philosophy of maintenance
- Inspection
- Examination

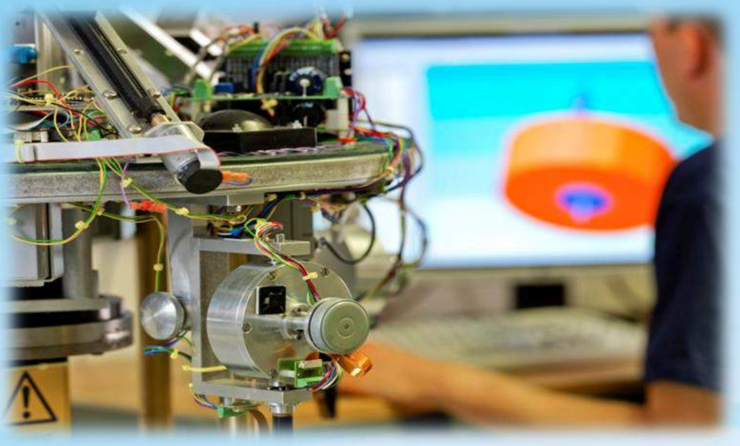
Case Study 5 -Maintenance of Earthing Systems

A discussion will follow presentations of the case study. Participants will be drawn out to take part in the discussion

ADVANCED CONTROL SYSTEMS

UETMT - ELEC- 108

Program Duration: 5 days



PROGRAM DESCRIPTION

Advanced Control Systems have created the world's most advanced distribution automation suite, including designing, planning, management and automatic feeder restoration. This Program ranges from revision of classical control, with particular attention to PID controllers, through to some recent developments in model-based multi-input multi-output control design. Topics include model identification, controller design, tuning and validation as well as model predictive control. Emphasis is given to important practical issues such as time delay systems and saturation actuators.

Throughout the Program examples of successful applications of the theory to real industrial problems are demonstrated through case studies, the aim being to develop Participants insight and intuition in dealing with real control engineering problems. The key feature of the Program is the hands-on sessions interspersed with the theory, where participants continually put into practice what is taught in lectures. These sessions are designed to address the issues of technical feasibility and economic justification of modern control in industry.

PROGRAM GOAL

The main goal that the Program aims to achieve is to provide practical knowledge and tools for design, analysis and implementation of both conventional and advanced control strategies.

TARGET AUDIENCE

This Program is intended for Engineers & highly qualified technicians working in the field of instrumentation and control in the process industries.

TARGET COMPETENCIES

- Design of Control Systems
- Analyze Linear Discrete-Time Systems
- Analyze and Design Digital Control Systems

PROGRAM OBJECTIVES

By the end of the Program, participant will be able to:

- Understand the basic concepts of the design of control systems using different techniques.
- Apply knowledge of methods for system identification and control design to the application. Insight into the process of experimental performance analysis and controller re-design.
- Analyze linear discrete-time systems.
- Analyze and design digital control systems.

PROGRAM CONTENT

- Introduction: The Excitement of Control Engineering.
- Definition of Modeling and Control Problems
- Advanced Control System development
- Model based Feedback Control
- Experimental methods and design approaches
- Cascade Control system
- Ratio Control System
- Advantage of feedback and feed forward
- Introduction to Multivariable Control and MPC
- Computer Control System, their Advantage Functions, how to select them (SCADA and DCS).
- Introduction to Fluid Power Systems, Pressure Losses in Hydrostatic Systems, Analysis of compressible Systems, Design and Analysis of Fluid Power Systems
- Limitations of Performance.

EMERGENCY DIESEL GENERATOR OPERATION

UETMT- ELEC- 109

Program Duration: 5 days

PROGRAM OVERVIEW

A general guideline associated with better-experienced knowledge about most items concerning the power system and generation units of power generation with DISELS ENGINES as prime movers and generating sets. Why it is important to learn this skill?

Diesel Engines are a significant prime mover in industrial & power and remote for off-shore and on- For this reason it is important for the technicians to understand the principles of operation and Maintenance involved in Diesel engines and generators and its operating philosophy as an emergency Unites as well as black start generators for power house.

PROGRAM DESCRIPTION

The cost of maintaining diesel generators can be a significant amount in the budget item of Manufacturing industries. this course gives a thorough understanding of diesel generators working, maintenance and failure modes and gives you the tools to maintain and troubleshoot The concluding section of the course gives the Fundamental tools in troubleshooting confidently and effectively.

PROGRAM OBJECTIVES

By the end of the course participants will learn to:

- Understand diesel engine operation and construction
- Specify protection requirements for diesel engines
- Specify speed control requirements for diesel engines
- Specify starting methods
- Fix faults on engine and generators
- Understand diesel engine maintenance &maintenance theory
- Improve plant safety
- Improve plant throughput
- Reduce spares usage and requirements
- Reduce plant down time, increase availability and reliability of emergency diesel generators

TARGET AUDIENCE

- Technicians and engineers who are responsible for maintaining, operations.
- Electrical Engineers and Technicians
- Mechanical Engineers and Technicians
- Operators at Power Plants
- Maintenance Technicians Electrical & Mechanical

TARGET COMPETENCIES

- Engineering Drawing I
- Mastering AutoCAD I
- Mastering AutoCAD II

PROGRAM CONTENT

Day 1:-

- AC theory Review
- Fundamentals of Generators Operation
- Generators Synchronization
- Generators Loading
- Generator Governor & AVR Control

Day 2

- Stability
- Generator Protection
- Parallel Operation and Load Sharing
- Load Shedding and Sharing
- Power Distribution Fundamentals

Day 3

- Principle segments of a Power Distribution System
- Voltage level used
- Distribution system levels and power generation isolating transformers
- Diesel engines introduction
- Diesel engines operation principals

DAY 4

- Diesel Engines starting System
- Diesel engines cooling System
- Diesel engines fuel system
- Exhaust system & Turbochargers

Day 5

- Diesel Engines Lubricating System
- Diesel Engines Control System
- Diesel Engines loading recommendation
- Diesel engines series and different type
- Maintenance of diesel engine
- Chicks and troubleshooting
- Monitoring panel

TRAINING METHODOLOGY

- Training methodology will include detail explanation of the subject. Course material through PowerPoint equipped with necessary animation, learning video and general discussion to provide participant with full understanding concerning the subject course this not limited but will extended to the following:
- Learning videos
- General discussion
- Practical session if any
- Learning examples
- Syndicate groups
- Workshop & Case Study

PROGRAM ASSESSMENT

- Pre & Post Test to be conducted before and after the course.
- Action Plan for each participant
- Evaluation to be conducted after the course at last day

ADVANCED ELECTRICAL EQUIPMENT: TROUBLESHOOTING AND MAINTENANCE

UETMT- ELEC- 110

Program Duration: 5 days

PROGRAM OVERVIEW

Planned maintenance inspections that are regularly implemented ensure that safe operations are effected and those losses of production due to fault outages are minimized. Maintenance inspections can inform the Technician of the current status and operability of the organization's Electrical systems and record the expected performance of the equipment life cycle.
The maintenance inspection methods, also indicates when spare parts are likely to be required and give greater accuracy of predictability necessary to forecast future planned maintenance schedules.

PROGRAM OBJECTIVES

This program is designed to give the skills and knowledge necessary for planning maintenance activities in Electrical Power Industry in accordance with International standards and also gives the engineers or technician a greater understanding of maintenance procedures post installation. It also covers "Preventative Maintenance" incorporating planning and scheduling of maintenance programs and Trouble Shooting techniques. Case studies are included for interactive discussions.

TARGET AUDIENCE

Managers, Engineers and Technicians involved in the maintenance and operations of HV and LV Electrical Equipment
It is also of great benefit to personnel who require a broad understanding of Electrical Maintenance Procedures due to their employment in related activities, e.g. government agencies, loan agencies etc. Design, Marketing and Project Management Personnel from manufacturers of electrical equipment should also benefit greatly from the seminar.

TARGET COMPETENCIES

•Power System Faults
•Safety Policies & Electrical Hazards
•Switchgear Testing, Maintenance & Failure Analysis

PROGRAM CONTENT

Power System Faults

- Different types of faults
- Incidence of faults on power system equipment
- Effects of power system faults
- Magnitude of fault current, short circuit calculations
- Detection of faults & Clearance of faults
- Fault current sources
- Machine reactor modeling
- Fault current characteristics
- Purposes of fault calculations
- Fault Studies (Equipment ratings, Asymmetric factors, Types of faults)
- Fault calculations

Safety Policies & Electrical Hazards

- Safety rules.
- Authorization levels.
- Safety documents.
- Hazardous associated with electrical equipment's.
- Electrical hazards to human.
- Arc Flashing hazards (IEEE 1584). (Incident Energy, Boundary distances, Labeling & PPE).
- Approved & standard organizations.

Power Quality Problems:

- Introduction to Power Quality - IEEE 1519.
- Grounding & Bonding.
- Mitigation techniques.
- Sources of harmonics, interharmonics and sub-harmonics.
- Harmonic Limits IEEE 519-2004.
- Capacitor banks.
- Voltages in the system.
- Harmonic measurements
- Voltage disturbances.
- Understanding harmonics.
- Effects on power system component.
- Calculating harmonic current.
- Harmonic filters.
- Solving problems in actual system.

Switchgear Testing, Maintenance & Failure Analysis:

- Switchgear overview.
- General breaker maintenance
  - Insulation resistance
  - Contact resistance tests
  - Mechanical checks
- CT & VT testing
- Relays testing
- SWGR Inspection and testing
- Maintenance intervals
- Preventive maintenance & Corrective maintenance.
- Troubleshooting and repair.

Transformer Maintenance:

- Transformer Maintenance - Insulation Testing, High Potential Testing, Turns Ratio Testing, Polarity Testing, Power Factor, Excitation Current, DC Winding Resistance, Polarization Recovery, Insulating Fluid Dielectric, Dissolved Gas Analysis.
- Transformers and Relaying - Transformer Faults, Differential Relaying.

Troubleshooting and Maintenance of UPS Systems:

Introduction to UPS – Brief.
Manufacturers Recommendations, Tools and Equipment & Electrical Safety.
Acid & Alkaine Batteries – Chemistry, Different types, Capacity Factors, Battery Safety and Maintenance, Float and Equalize Voltages, Load Testing.

Troubleshooting of Motors & Troubleshooting Industrial Motor Control Systems

- Introduction to motors & motor controllers.
- Motor Protection units.
- The troubleshooting method
- Know the motor
- Investigate the symptoms
- Analyze the symptoms and list probable causes
- Test the probable causes
- Discover the root causes
- Troubleshooting cases

Cables Testing & Maintenance

- Different tests to LV & HV cables.
- Acceptable criteria.

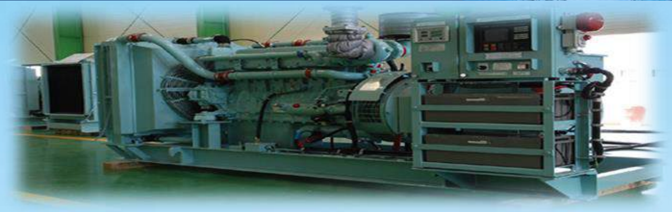
Ground Grid Systems

- Purpose & Grounding theory,
- Types of test equipment, Inspection & Testing.

EMERGENCY DIESEL GENERATOR

UETMT- ELEC- 111

Program Duration: 2 days



PROGRAM OVERVIEW

A general guideline associated with better-experienced knowledge about most items concerning the power system and generation units of power generation with Diesels Engines as prime movers and generating sets. Why it is important to learn this skill?
Diesel Engines are a significant prime mover in industrial & power and remote for off-shore and on- For this reason it is important for the technicians to understand the principles of operation and Maintenance involved in Diesel engines and generators and its operating philosophy as an emergency Unites as well as black start generators for power house.

PROGRAM DESCRIPTION

The cost of maintaining diesel generators can be a significant amount in the budget item of Manufacturing industries. this course gives a thorough understanding of diesel generators working, maintenance and failure modes and gives you the tools to maintain and troubleshoot The concluding section of the course gives the Fundamental tools in troubleshooting confidently and effectively.

PROGRAM OBJECTIVES

By the end of the course participants will learn to:

- Understand Diesel Engine Operation and Construction
- Specify Protection requirements for Diesel Engines
- Specify Speed Control requirements for Diesel Engines
- Specify starting methods
- Fix faults on engine and generators
- Understand diesel engine maintenance &maintenance theory
- Improve plant safety
- Improve plant throughput
- Reduce spares usage and requirements
- Reduce plant down time, increase availability and reliability of emergency diesel generators

PROGRAM COMPETENCIES

- Diesel Engine Operation and Construction
- Diesel Engine Starting Methods

TARGET AUDIENCE

- Technicians and Engineers who are responsible for maintaining, Operations.
- Electrical Engineers and Technicians
- Mechanical Engineers and Technicians
- Operators at Power Plants
- Maintenance Technicians Electrical & Mechanical

PROGRAM CONTENT

DAY 1

- AC theory review
- Fundamentals of Generators Operation
- Generators Synchronization
- Generators Loading
- Generator Governor & AVR Control
- Stability
- Generator Protection
- Parallel operation and load sharing
- Load shedding and sharing
- Power distribution fundamentals
- Principle segments of a power distribution system
- Voltage level used
- Distribution system levels and power generation isolating transformers

DAY 2:

- Diesel Engines Introduction
- Diesel Engines operation principals
- Diesel Engines starting System
- Diesel Engines Cooling System
- Diesel Engines Fuel System
- Exhaust System & Turbochargers
- Diesel Engines lubricating system
- Diesel Engines control system
- Diesel Engines loading recommendation
- Diesel Engines series and different type
- Maintenance of Diesel Engine
- Chicks and Troubleshooting
- Monitoring Panel

TRAINING METHODOLOGY

Training methodology will include detail explanation of the subj. course material through power point equipped with necessary animation and general discussion to provide participant with full understanding concerning the subject course this not limited but will extended to the following

- Learning videos and class lecture supported with full detailed presentation.
- General and group discussion as well as class quiz.
- Practical session if any.
- Learning examples.
- Pre and final Assessment.

ELECTRICAL INSPECTION AND TESTING

UETMT- ELEC- 112

Program Duration: 5 days

PROGRAM OBJECTIVES

The course provide essential, basic operational principles of test & inspection on electrical equipment. Information on the utilization of electrical portable measurements and testing equipment and how it's detecting damages, detecting improper installation, detecting non-conformance with performance specifications, establishing base data for maintenance testing and measurements.

TARGET AUDIENCE

- The course is designated for Maintenance engineers & operation supervisors and technician whom engaged in oil and gas, petrochemical fields and industry.
- Plant engineers, project, instrument and control engineers
- Maintenance personnel, service, technicians
- Electrical Maintenance technicians and supervisors

TARGET COMPETENCIES

- AC and DC Circuits
- Insulating Fluid Dielectric Tests

PROGRAM CONTENT:

Day 1:

- Mathematical relationships: AC and DC circuits
- DC Circuits: voltage, current, resistance, and power AC circuits
- Voltage, Current, impedance, power, and power factor average, peak, and RMS values of waveforms resolution of complex waveforms into harmonic
- Basic operational principles of test equipment electro-mechanical meter movements numerical-display (digital) units ammeters clamp-on ammeters
- Voltmeters ,wattmeter's and ohmmeters
- Voltage transformers
- Current transformers
- Multi-meters
- Transducers
- Accuracy, frequency response factor, precision, and errors of electrical tests
- Accuracy electro-mechanical meter movements numerical-display (digital) units ammeters, voltmeters, and wattmeter's ohmmeters
- Instrument transformers and transducers
- Safety considerations of electrical tests isolation of sources of electrical power
- The Technology of Electrical Equipment
- Transformers – Switchgears – Circuit breakers – Disconnect switches - Power transformer – Motor control centers (MCC) – UPS – Batteries – AC Motors – Generators - Neutral ground resistors – Motor operated valve - Motor/feeder protective devices - Control relays/timers/switches - Programmable logic controllers (PLC) - Variable frequency/speed drives (VFD/VSD - Control relays/timers/switches.

Day 2:

- Factors justifying more than one kind of test.
- Erroneous measurements and inaccurate interpretations
- Factors for justifying tests of new equipment distinction between acceptance testing and maintenance testing reasons for acceptance testing
- Detecting damages detecting improper installation detecting non-conformance with performance specifications establishing base data for maintenance testing ac and dc applied-potential test sets evaluating ac applied-potential tests ac applied-potential tests: applications and methods evaluating dc applied-potential tests dc applied-potential tests: applications and basic methods
- Evaluating insulating fluid dielectric tests insulating fluid dielectric tests: applications and methods effects of water contamination effects of temperature evaluating applied potential test resources used to evaluate an ac applied-potential test
- Hi put test
- Impulse test
- Evaluating applied potential test
- The Use of Test Equipment
- Digital voltmeter (DVM) – Oscilloscopes – Tachometer - Temperature probes/pyrometers – AVO meter – Clip-on meter – Earth resistance tester - Load banks – H pot. Tester - Load banks – oil tester - Digital hydrometers - Cable fault locators

Day 3:

- Insulation Tests Equipment
- Electrical characteristics of insulation,
- Conductors, and semiconductors, and general
- Physical behavior of insulation under electrical
- Stress
- Insulation characteristics
- Conductor characteristics.
- semiconductor characteristics
- general physical behavior of insulation under stress
- physical behaviors of specific insulation materials
- And construction arrangements of insulation
- megohmmeter insulation-resistance test sets and tests: operational principles, basic constructions,
- Applications and methods.
- insulation power-factor test sets and tests:
- Operational principles, construction, applications, and methods
- Evaluating insulation power-factor tests air temperature and humidity
- Hi put test
- Thermal withstand test
- Historical trend
- engineering database
- Leakage current tester
- Inspection and Testing of Electrical Equipment
- Methods – Terminology – Principles – Special techniques – Troubleshooting of Electrical Equipment - Case studies - Single line drawings - Group exercises

Day 4:

- Fundamentals of electrical equipment
- Cable fault localization
- Cable thumping: equipment constructions, operational
- Principles and basic localization techniques
- Equipment construction, operational
- Principles and basic localization techniques
- Time-domain reflectometry: equipment constructions,
- Operational principles and basic localization techniques
- Importance and Necessity for Inspection and Testing.
- Common mode failures - Phase imbalance - Contact pitting/arcing - Electronic component failure – Fusing - Motor windings/bearings/brushes – Ballasts - Excitation circuits - Battery cells - Inverters/rectifiers – Bushings – Switches - Control circuits - Ground faults - Case Studies

Day 5:

- Over current tests portable Electrical equipment
- Current Injection Tests: purposes and applications
- Typical applications
- Current injection test sets: operational principles and
- Constructions
- Time-over current plots.
- Evaluating current injection tests.
- Evaluation factors resources used to evaluate a current injection test
- Circuit resistance tests
- Low-resistance test sets: constructions and operational
- Principles
- Evaluating primary-circuit resistance tests
- Evaluating circuit continuity tests
- Evaluating equipment faults
- evaluating terminal-to-terminal resistance tests
- evaluation of earth-resistance tests .
- .. Voltage excitation tests
- evaluating turns ratio tests
- Turns ratio tests: purposes and basic techniques
- Evaluating instrument transformer ratio and excitation current tests
- Ratio and excitation current testing of instrument transformers: principles and techniques thermal portable camera.
- Vibrations test equipment
- The Interpretation and Use of Drawings and Safety.
- Single-line diagrams - schematics diagram Wiring diagrams – Ladder diagrams - Wiring lists - Logic and standard symbols - The Development of a Job Plan - Identification of the troubleshooting step-by-step sequence - Procedure preparation – Documentation - Safety considerations and training - A review of Safety Requirements - Area classifications - NEC electrical codes - Safety information

DIESEL POWER PLANT OPERATION & MAINTENANCE

UETMT - ELEC- 113

Program Duration: 5 days

PROGRAM OBJECTIVES

To improve the understanding of Diesel Power Plant Operational and Maintenance employees and supervisors

TARGET COMPETENCIES

- Reciprocating Internal Combustion Engines
- Generator System

PROGRAM CONTENT

Fundamental of Reciprocating Internal Combustion Engines (Diesel Engine) :

- Classifications of engines
- Working cycles
- Turbo charging

Prime Mover and Generator System

- Lubrication system
- Cooling system
- Engine speed
- Fluid level monitoring
- Engine shutdown

Operation and Maintenance

- Technical Manual
- Plant Operation
- Operating Records
- Maintenance Strategies
- The Preventative Maintenance program
- Servicing schedules(Engines, cooling & air induction systems, turbochargers, top & major overhaul and generator servicing)
- Spare Schedule
- Maintenance strategies
- Maintenance scheduling- condition monitoring
- Maintenance routines- quality work
- Spare parts logistics
- Maintenance planning

Review on Caterpillar Diesel Engine Manual as example for Operation and Maintenance:

- Engine protection Devices
- Before starting the Engine
- Engine starting
- Normal Operation
- Fuel problems, cooling & lubricating specifications
- Maintenance Schedule
- Turbo Charger
- Turbine
- Compressor
- Intercooler

Diesel Engine Performance

- Power
- Thermal Efficiency
- Pollution Control

CABLES: SELECTION, TESTING, SPLICING & INSTALLING

UETMT - ELEC- 114

Program Duration: 3 days

PROGRAM OBJECTIVES

This course is designed to empower participants as a comprehensive update provides trainee with information and practical experience about the power cables characteristics, testing, fault location and splices and to ensure that the attendee understands how and why cable testing and maintenance are important.

TARGET AUDIENCE

For the Electric Technicians and Engineers who are responsible for maintaining lying, Connection, Maintenance and Testing Power Cables.

TARGET COMPETENCIES

- Cables Conductor
- Semi Conducting Screen
- Insulation

PROGRAM CONTENT

Day 1: The Power Cables Instruction

- Cables Conductor
- Electrically Non-Conducting Materials In the Cables
- Compositions of Power and Control Cables
- Semi Conducting Screen
- Insulation
- Armoring
- Current Ratings of Power Cables
- Volt-drop within a Cable
- Heat dissipation during short circuits
- Earth fault loop impedance
- Protection against Overloading Current
- Cables with Special Performance
- Comparison between Overhead & underground cables
- Cable Sizing and Specifying
- Cable sizing techniques
- De-rating Factors for various temperatures
- Underground installations for industrial, commercial, and mining applications
- Power Cable Applications for different Installations Utility Industrial
- Cable Installations
- Indoor & Outdoor

The Power Cables General Information

- IEC Publications related to Power Cables
- Darting Factors
- Short Circuit Current
- Voltage drop for the cables
- System designation for over head cables
- System designation for M.V and H.V cables
- Cables clarification sheet
- 132 and 22o KV XPLE cables
- Handling and laying instructions
- Multi-conductor Cable for Control and Instrument Applications
- Wire and Cable Size What is the AWG definition
- What is the mm^2 definition

ELECT SAFETY, LOCKOUT, TAGOUT, HAZARD AREA CLASSIFICATION, ELECT STANDARDS AND REG

UETMT - ELEC- 115

Program Duration: 5 days

PROGRAM OVERVIEW

This highly relevant seminar is intended for electrical engineers and technicians involved in electrical safety. And those are responsible for general considerations of accident presentation.
The program can be used as an introduction to the field of fire fighting, personnel safety, machines safety and safety control for persons who are interested to work in safety area.

PROGRAM GOAL

The program presents a systematic approach to the basics of protection of electrical accidents, results from hazardous voltages and currents. It first adopts a general approach to the main accidents reasons and the method of avoiding them. Then it explains what is meant by hazardous voltages and currents Electrical Injuries Mechanisms through human bodies is illustrated, different types, and its use in different Electrical Earthing and protection is also given. The protection and insulation and its associated control circuit will be deeply involved in this program with some applications in industry.

PROGRAM OBJECTIVES

By the end of the program, participant will be able to:

- Gain an understanding of basic accidents and fire fighting procedures and electrical protection and insulation and its applications.
- Identify first aids and how it can perform instantaneously and how it can be effective and its application in electrical utilities and different aspects of industry.
- Gain some knowledge of how to perform simple protection procedures for fire fighting.
- Understand most of the electrical presentation tools and first aide devices in most of their work.

TARGET COMPETENCIES

- Fire Fighting Procedures
- Electrical Protection and Insulation

PROGRAM CONTENT

General Considerations of Accident Presentation

- Definitions
- Electric accidents classifications
- Analysis of accident data
- Statistical analysis of accidents
- Electrical injuries

Electrical Injuries Mechanisms Through Human Body

- Mechanisms
- Respiratory system failure
- Alertness factor
- Current path

Affected Organisms

- Environmental factors
- Nervous system
- Living tissues
- Human electrical resistance

Hazardous Voltages and Currents

- Voltage
- Current
- Frequency

Electrical Codes

- IEEE
- SCC
- QMP
- CEC

ELECTRICAL LOAD FORECASTING

UETMT - ELEC- 116

Program Duration: 5 days

PROGRAM OBJECTIVES

The objectives of the program ***Electrical Load Forecasting*** include the desire to acquaint electric power engineers and qualified technicians with general explanation of electrical load forecasting. The electrical systems in power plants include those parts associated with connecting the station to the grid and the ones that distribute power to the auxiliary systems inside the station are also included. Integrated resource planning (IRP) in power systems require the future loads and the growth rate of power system which is the main part of this proposed short program. The reactive power control is also the main desire of this short program as well as the voltage control. This includes a functional description of electrical system details, 380 kV system, 13.8 kV, 4.16 kV, and 480 V systems. The program will include another objective for selection and application of the best transmission and distribution forecast methods for any particular situation.

TARGET AUDIENCE

All Engineers and Technicians involved in the power sectors and power station operation, planning, and maintenance, and also in the factories, and enterprises, especially in power station electrical systems

TARGET COMPETENCIES

- Electrical System.
- Electric Power Distribution
- Power Quality State Estimation

PROGRAM CONTENT

Introduction:

- General Explanation of Electrical System.
- Review of electric power distribution load forecasting (how it is done).
- Practical forecasting and planning methods.
- Basic theory and mathematics of modern distribution load forecasting.
- Power Quality State Estimation.

Utilization of the spatial electric Load Forecasting Software:

- Modern Methods for Planning Capacity need of Power delivery Transmission and Distribution (T&D) Systems.
- Power Plant Outages and Faults.
- Uninterruptible Power Supply (UPS) Systems
- Examination of T&D planning and forecasting needs
- Load behavior and Load Growth Characteristics

Accuracy and Information Content Requirements:

- Various T & D load forecasting methods along with advanced topics.
- Forecasting for integrated resource planning (IRP), value – based Planning.
- Competitive Retail Planning

Switch Gear:

- Circuit Breakers.
- Switchboard and Panel Board.
- Fuses, Disconnecting Links, etc.

Detailed review of two T & D load forecast.
Guidelines for selection and application of the best T&D forecast methods for any particular situation:
Case Study

ELECTRICAL INSTALLATIONS & MAINTENANCE

UETMT- ELEC- 117

Program Duration: 5 days

PROGRAM OVERVIEW
The electrical designer, installer and maintenance team are all expected to provide an installation that is safe, cost effective and reliable.
Beginning with the fundamental principles that always apply to ensure safety, the program then progresses through basic design, testing and maintenance aspects, concluding with a review of power quality problems that affect the reliability of any installation where high technology interfaces with the supply.

PROGRAM OBJECTIVES
This program is intended to develop knowledge of both the safety and functional requirements of an installation.

TARGET AUDIENCE
This program is directed at electrical technicians, maintenance managers and electrical engineers who would like to expand their knowledge of the safety and functional characteristics that result in the reliability of an electrical installation.

TARGET COMPETENCIES
Safety and Functional Requirements of an Installation

TRAINING METHODOLOGY
The program is conducted as modular lectures with encouragement for the delegate to interact. Case studies are included to illustrate how problems can develop as technology changes
A design project is included to enable the delegate to practice the techniques of calculating the parameters of loads, protective devices and cable sizing for safety and functional purposes. A calculator will be required for this phase of the program.
Questions are welcomed throughout the program and during break sessions.

ORGANIZATIONAL IMPACT
- Delegates will have new knowledge and techniques that will allow them to understand and implement the requirements for electrical installation design and maintenance.

- This will be applicable to new design requirements and existing systems, and will help the organization to improve its effectiveness in ensuring a compliant and reliable electrical installation.

PERSONAL IMPACT
- On successful completion of this program, delegates will understand:
- The basis for safety and functional design.
- How to assess the characteristics needed to commence a design process.
- How to change the installation design where power quality may affect the reliability of the supply.
- How new technology impacts on new and existing electrical installations.
- Inspection and testing techniques that affect the maintenance routine of an installation.
- How to improve productivity by improving the reliability of an installation.

COMPETENCIES EMPHASISED
- Understanding the design and maintenance requirements for electrical installations.
- How to assess the key characteristics of electrical installations.
- Design and modification of installations to withstand failures in power quality.
- How to maintain an electrical installation, including inspection and test procedures, and maintenance management.

PROGRAM CONTENT
Day 1: Preliminary Design Requirements
- The design process requires consideration of the installation requirements with respect to the load characteristics, the circuit arrangements, and the source of supply.
- Building services
- Purpose of an installation
- Cables
- External influences
- Transformers
- Compatibility
- Protective devices
- Maintainability

Day 2: Design Characteristics
- To enable work to begin on any electrical installation a detailed specification is required. This specification will be based on the safety and functional requirements considered in day 1.
- Electrical safety
- Cable installation
- IEC 60364
- Terminations
- Wiring regulations
- Inspection and testing
- Cable sizing
- Documentation

Day 3: Designing an Installation
- Building on the first two days of the program this module puts into practice the theories developed.
- Single phase design
- Power quality
- Three phase design
- Cable requirements
- Protective device selection
- Installation method
- Earthing and bonding
- Source of supply

Day 4: Commissioning and Testing
- The requirements for any maintenance routine begin during the design process and continue though installation into operation. In many countries there is also a legal requirement to maintain an installation in a safe condition.
- The need to maintain
- Test results
- What is maintenance
- Documentation
- Introduction to commissioning
- Harmonics
- Inspection
- Earth leakage

Day 5: Periodic Maintenance
- After the initial verification of the safety and function of the installation it is necessary to ensure that safety remains effective throughout the lifetime of the installation.
- Maintenance Planning
- Periodic inspection
- Equipment reliability
- Complex testing
- Categories of system
- Harmonic analysis
- Safety critical
- Records

CIRCUIT BREAKER CONTROL

UETMT - ELEC- 118

Program Duration: 5 days

PROGRAM DESCRIPTION

This highly relevant program is intended for Electrical Engineers and Technicians involved in Electrical Utilities. And those are responsible for general considerations of Circuit Breaker Control.
The program can be used as an introduction to the field of power utilities and power systems planning and operation.

PROGRAM OBJECTIVES

- With the ever increasing demand on electric energy, larger and larger generating units have been installed. All these reasons necessitates a Circuit breakers control
- The program presents a systematic approach to the control. It first adopts a general approach to the main power system. Then it explains what is meant by various power systems types. Familiarization with principles of generation, transmission, distribution methods, design and its associated calculations. The understanding of the principles and techniques of design of CB control is explained.
- Upon completion of this program, participants will gain an understanding of CB control techniques with all safety precautions will be adopted. . They will be aware of modeled case circuit breakers and large air circuit breakers.

TARGET AUDIENCE

- Electrical Engineers.
- Senior technicians who work in the electrical control and power utilities.
- Technicians who would like to refresh their knowledge.
- Mechanical and chemical Engineers who are interested in control subjects.

TARGET COMPETENCIES

- Circuit Breakers Control
- Low Voltage CB
- High Voltage CB

PROGRAM CONTENT

INTRODUCTION

- Power Systems
- PS Contents
- Switch Yard
- Main Lines

CIRCUIT BREAKERS

- Types
- Construction
- Low Voltage CB
- High Voltage CB

CB MAINTENANCE

- Modeled Case CB
- Large Air CB.
- Circuit breakers Manually Operated

CB CONTROL

- CB Ratings
- CB Control Schematic
- Sections Configurations
- CB Measurements

CASE STUDIES

CONTROL CIRCUITS

UETMT - ELEC- 119

Program Duration: 5 days

TARGET COMPETENCIES

- Analog Signal Conditioning
- Digital Signal Conditioning
- Thermal Sensors

PROGRAM CONTENT

Introduction:

- Control Systems
- Process Control Block Diagram
- Control System Evaluation
- Analog and Digital Processing
- Units, Standard and Definitions
- Sensor Time Response

Analog Signal Conditioning:

- Passive Circuits
- Operational Amplifiers
- OP Amp Circuits in Instrumentation
- Design Guidelines

Digital Signal Conditioning:

- Review of Digital Fundamentals
- Converters
- Data Acquisition Systems

Thermal Sensors:

- Definition of Temperature
- Metal resistance Versus Temperature Devices
- Thermistors
- Thermocouples
- Other Thermal Sensors
- Design Considerations

Mechanical Sensors:

- Displacement, Location or Position Sensor
- Strain Sensor
- Motion Sensors
- Pressure Sensors
- Flow Sensors

Optical Sensors:

- Fundamentals of EM Radiation
- Photo-detectors
- Pyrometry
- Optical Sources
- Applications

Final Control:

- Final Control Operation
- Signal Conversions
- Industrial Electronics
- Actuators
- Control Elements

Discrete-State Process Control:

- Definition of Discrete-State Process Control
- Characteristics of the System
- Relay Controllers and Ladder Diagrams
- Programmable Logic Controllers (PLCs)

Controller Principles:

- Process Characteristics
- Control System Parameters
- Discontinuous Controller Modes
- Composite Control Modes

Analog Controllers:

- General Features
- Electronic Controllers
- Pneumatic Controllers
- Design Considerations

Digital Controllers:

- Digital Electronics Methods
- Computers in Process Control
- Characteristics of Digital Data
- Controller Software

Control Loop Characteristics:

- Control System Configurations
- Multivariable Control Systems
- Control System Quality
- Stability
- Process Loop Tuning

BASIC ENGINEERING DRAWING

UETMT - ELEC- 120

Program Duration: 5 days

PROGRAM OBJECTIVES

By the end of this program, the participants will be able to:

- Read Professional Engineering Drawings
- Draw Technical Drawings

TARGET AUDIENCE

This program is suitable for Operators/Technician who has attended a basic Technical Drawing Program for Beginners.

TARGET COMPETENCIES

- Engineering Drawing I
- Mastering AutoCAD I
- Mastering AutoCAD II

RELATED PROGRAMS

- Engineering Drawing I (Basic)
- Mastering AutoCAD I for Beginners
- Mastering AutoCAD II for Advanced Users

PROGRAM CONTENT

Module 1:

Introduction

Intersection of Solids

- Intersection of Two Cylinders
- Intersection of Cylinder and Cone

Auxiliary Views

Sectional Views

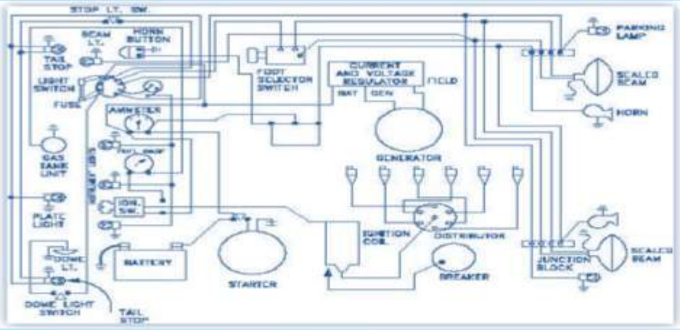
- Half Sections
- Revolved Sections
- Offset Sections
- Aligned Sections
- Ribs in Sections
- Conventional Breaks

Dimensioning

- Direction of Dimension Figures
- Dimensioning Angles
- Dimensioning Arcs
- Finish Marks
- Dimensioning of Threads
- Dimensioning of Chamfers
- Size Dimensioning of Holes
- Do's and Don'ts of Dimensioning

Fits and Tolerance

- Terms Definitions
  - Nominal Size
- Actual Size
  - Tolerance
  - Limits



- Fits between Mating Parts
  - Clearance Fit
  - Interference Fit
  - Transition Fit
- Basic Hole System
- Basic Shaft System

Surface Roughness

Assembly Drawing

Module 2:

Introduction

Main Drawings Types

- Process Flow Diagram (PFD)
- Plot Plans
- Piping Drawings
- Instrumentation Diagram (P&ID)

Piping Drawings

- Line Type Standard
- Line Number
- Pipe Line Presentation
  - Single Line Presentation
  - Double Line Presentation
- Plans & Views
- Pictorial (Isometric) View

Pipe Fittings and Valves

- Valves Symbols
- Flanges
- Some Equipment
- General Symbols
  - Reading Schematic & Symbols
  - Computer Aided Draught System (CAD)

13.8 KV GENERATOR CONSTRUCTION, OPERATION, PROTECTION, VOLTAGE REGULATION, TESTING AND MAINTENANCE

UETMT- ELEC- 121

Program Duration: 3 days

PROGRAM OVERVIEW

This program is aimed to provide deep knowledge & experience on the applications of power system generation & distribution in the field of oil & gas industries. Where as a practical based knowledge of electrical generation and equipment could be applied on different case studies and gives a rule of thumb relevant to deal with the Electrical Equipment

PROGRAM OBJECTIVES

- Delegates will gain a detailed appreciation of learnt from this training to interactive with the power plant equipment & network to identify , evaluate & put the suitable remedies for faults & troubles to get a stable operation and good plan for equipment maintenance. Concerning the following
- Different types of generator's prime movers focuses on gas turbines & Diesel engine Main components, operations, control, protection and load control, starting & stopping sequence
- Generator theory, main components, types, Excitation system, AVR, Regulation, synchronizing of generators and parallel operations, load sharing –shedding system, generator protections, fault finding and trouble shootings typical exercises & Maintenance for generator and its associated Auxiliaries system – operators duties in control room

TARGET AUDIENCE

This course is aimed at all Personnel involved in power plants operation & maintenance. The program is based on multi-disciplinary approach, which includes all personnel from Operators, Technicians, Supervisors, New graduated to Senior Engineers.

TARGET COMPETENCIES

- Power Plant Equipment
- Electromotive Force
- Purpose of Generators

PROGRAM CONTENT

Day 1

- Explain the principles of Magnetism.
- Define the Term Generator action
- Define the Term Electromotive force.
- Explain the Purpose of Generators.
- Explain how voltage is induced in a stationary armature
- Explain how a Magnetic field is produced on a Rotor
- Explain how three-phase voltage is produced.
- Learning video on generator principal

Day 2

- Describe the Construction of an AC Generator Stator.
- Generator Auxiliaries and Cooling System
- Excitation and AVR and Voltage Control
- Frequency control and speed Governor
- Generators synchronization and parallel operation
- Describe Load Sharing
- Gas Turbines & Types of Prime Movers
- Main components & operations of single shaft gas turbines
- Main components & operations of Two shaft gas turbines
- Main components & operations of Diesel Engine
- Starting & stopping sequences
- Protection & load control

Day 3

- Generator under Normal and Abnormal Conditions
- Generator Operation and Load Sharing
- Generator Protection Schemes
- Generator Tests
- Generator Maintenance and Troubleshooting
- Preventive Maintenance of Generator
- Preventive Maintenance of Generator's Auxiliaries
- Troubleshooting and Fault Finding Typical practical Case Study

ELECTRICAL POWER SUBSTATION MAINTENANCE

UETMT - ELEC- 122

Program Duration: 5 days

PROGRAM DESCRIPTION

There is considerable interest among people who operate and maintain electrical power systems in a Wide range of topics relating to equipment maintenance and testing. This is because condition and reliability are directly related to maintenance and testing

To obtain maximum life from electrical equipment, maintain its reliability, and minimize repair cost, it is necessary to serve and test it periodically to predict condition.

Proper installation and preventive maintenance of substation will assure continued electrical power supply, it is very important to the consumers specially, for industrial sector where the curtail of Electrical Power supply is costly.

PROGRAM OBJECTIVES

To perform proper maintenance on substations Equipment, including transformers, circuit breakers, bus bars, metering, protective devices, batteries...etc.

The attendance will become familiar with substation standards.

TARGET AUDIENCE

This program is intended for Electrical Engineers &Supervisors, who work in operation, maintenance, protection, control and analysis of Utilities & Industries Electrical Networks.

TARGET COMPETENCIES

- Electrical Equipment Maintenance
- Power System Components
- Sub-Station Components

PROGRAM CONTENT

- Introduction to Electrical Equipment Maintenance & Testing
- Power System Components
- Sub-Station Components
- Schematic Diagrams
- Overview of Electrical Preventive Maintenance & Testing
- Overview of Testing & Test Methods
- Transformers
- Preventive Maintenance of Transformers
- Dry Type & Liquid Type Transformers- Installation, Acceptance & Maintenance
- Transformer Testing
- Instrument Transformers
- Maintenance & Testing of Instrument Transformer
- Electrical Switchgear Testing
- Electric switchgear Maintenance
- Protective Relays
- DC (Battery) Control Power Equipment
- Grounding Resistance Measurement
- Case Studies & Discussions

ELECTRICAL GENERATOR & POWER TRANSFORMERS

UETMT- ELEC- 123

Program Duration: 5 days

PROGRAM OBJECTIVES

Upon completion of this course, the participants will be able to explain the function, Design, and Construction of AC and Troubleshooting

TARGET COMPETENCIES

- Principles of Magnetism
- Electromotive Force
- AC Generator Stator

TARGET AUDIENCE

Electrical Maintenance Technicians and Operators

PROGRAM CONTENT

Day 1

- Explain the Principles of Magnetism.
- Define the Term Generator action
- Define the Term Electromotive force.
- Explain the Purpose of Generators.
- Explain how voltage is induced in a stationary armature
- Explain how a Magnetic field is produced on a Rotor
- Explain how three-phase voltage is produced.
- Learning video on generator principal

Day 2

- Describe the Construction of an AC Generator Stator.
- Generator Auxiliaries and Cooling System
- Excitation and AVR and Voltage Control
- Frequency control and speed Governor
- Generators synchronization and parallel operation
- Describe Load Sharing

Day 3

- Generator under Normal and Abnormal Conditions
- Generator Operation and Load Sharing
- Generator Protection Schemes
- Generator Tests
- Generator Maintenance and Troubleshooting

Day 4: Power Transformers Characteristics

- Principles of Transformers
- Magnetic Field
- Basic theory
- Practical or non ideal Transformer
- Leakage flux
- Winding Resistance
- Magnetizing current and core loss
- Calculation of efficiency of a Transformer
- Transformer Connection
- Voltage regulation and efficiency
- Losses of Transformers
- Transformers Parallel operation
- Learning video on transformer principal
- Open Discussion
- Class Problems
- Pre-assessment

Day 5: Power Transformers Construction

- Transformer Construction
- Core Construction
- Winding Construction
- Cooling (Radiators and Fans)
- Transformer Cooling
- Methods of Cooling of Power Transformers
- Oil immersed type transformers
- Dry type transformers
- Transformer protection
- Learning video internal parts

ELECTRIC POWER GENERATION, TRANSMISSION AND PLANNING

UETMT - ELEC- 124

Program Duration: 5 days

TARGET AUDIENCE

In general, Electrical Power Engineers, Supervisors and Qualified Distribution System Technicians can take part in this program.

TARGET COMPETENCIES

- Fossil Power Plants
- Advanced Energy Technologies
- Distribution Systems
- Transmission System

PROGRAM CONTENT

Electric Power Generation: Conventional Methods

- Introduction
- Fossil Power Plants
- Nuclear Power Plants
- Geothermal Power Plants
- Hydroelectric Power Plants
- Synchronous Machinery
- Thermal Generating Plants
- Distributed Utilities

Electric Power Generation: Non-Conventional Methods

- Wind Power
- Advanced Energy Technologies
- Photovoltaic

Fundamentals of Distribution Systems

- Primary Distribution Configurations
- Urban Networks
- Primary Voltage Levels
- Distribution Substations
- Sub-transmission Systems
- Differences between European and North American Systems
- Loads
- The Past and the Future

Transmission System

- Concept of Energy Transmission and Distribution
- Transmission Line Structures
- Insulators and Accessories
- Transmission Line Construction and Maintenance
- Insulated Power Cables for High-Voltage Applications
- Transmission Line Parameters

Power System Operation and Control

- Energy Management
- Generation Control: Economic Dispatch and Unit Commitment
- State Estimation
- Optimal Power Flow

Transformers

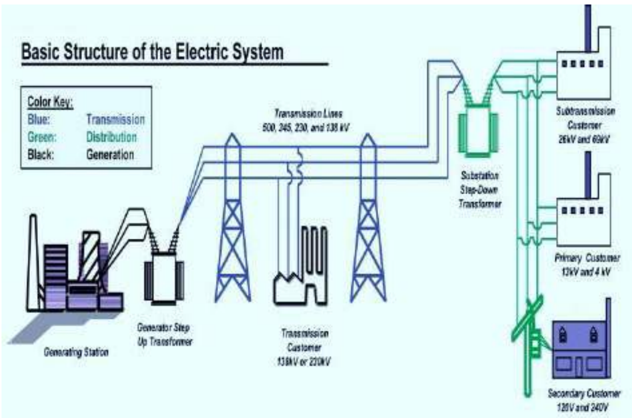
- Theory and Principles
- Power Transformers
- Distribution Transformers
- Underground Distribution Transformers

Power System Planning (Reliability)

- Planning
- Short-Term Load Forecasting
- Short-Term Price Forecasting
- Transmission Plan Evaluation — Assessment of System Reliability
- Power System Planning
- Power System Reliability

Distribution System Planning and Automation

- Introduction
- Distribution System Planning
- Factors Affecting System Planning
- Present Distribution System Planning Techniques
- Distribution System Planning Models
- Distribution System Planning in the Future
- Future Nature of Distribution Planning
- The Central Role of the Computer in the Distribution Planning.
- Impact of Dispersed Storage and Generation.
- Distribution System Automation.



ELECTRICAL PREVENTIVE MAINTENANCE

UETMT - ELEC- 125

Program Duration: 5 days

PROGRAM DESCRIPTION

Statistics indicate that more fires start from electrical system failure than from any other cause. Electrical equipment is usually well designed and properly installed. However, the principal reason for electrical system breakdown is the failure to maintain the installation in its designed state.

As soon as electrical equipment is installed, normal deterioration begins. If left unchecked, the deterioration process can cause malfunction or complete failure. Performance and life expectancy of the equipment are decreased by factors such as environmental conditions, system overload or excessive duty cycles on equipment. These factors when combined with neglect can result in premature breakdown.

Instituting a preventive maintenance program which consists of routine inspections, tests and service of electrical equipment can significantly reduce the potential for breakdown. Without an electrical preventive maintenance program, your facility assumes a risk of serious electrical failure and the heightened potential consequences of fire and/ or production interruption.

PROGRAM OBJECTIVES

The program has been designed to meet objectives in both the cognitive and affective educational domains to provide the participants with not only the “what’s” of the electrical work practices but also the “whys”. It meets the requirements for training on "Electrical Maintenance-Related Work Practices" for those electrical and non-electrical support personnel whose work may expose them to the hazard of being near or exposed to electrical parts operating at low, medium or high voltages.

It is designed to enhance a good working performance of personnel through detailed program aspects. Various interactive instructional techniques will be used throughout the Program including the use of Participant/Observer role-playing using video case studies of actual accidents to help the participants use the information learned from this Program both at work and at home

Upon completion of this Program, the participant should be able to:

- Identify the function and operation of the electrical equipment
- Identify components of a successful electrical preventive maintenance program.
- Determine the Personal Protective Equipment (PPE) requirements for electrical troubleshooting.
- Safely and correctly verify a circuit is de-energized.
- Distinguish between the different types of electrical maintenance.
- Perform proper maintenance on substations Equipment.
- Identify different types of transformers.
- Perform proper maintenance on transformers.
- Identify and perform proper maintenance on H.V. Switchgear and Underground Cables
- Observe power quality problems and troubleshooting techniques for facility distribution systems and three-phase loads.
- Be ready to read and interpret electrical diagrams.

TARGET AUDIENCE

- The Program curriculum is designed Especially for Electric Power Engineers, Plant Engineers, Apprentice Electricians, Journeyman Electricians, Maintenance Technicians, Supervisors, and Inspectors.

TARGET COMPETENCIES

- Engineering Maintenance
- Preventive Maintenance
- Engineering Services For Substations

PROGRAM CONTENT:

Overview of Electrical Systems

- Basic Elements of Electrical Generation, Transmission & Distribution Systems

Introduction to Engineering Maintenance

- Background
- Maintenance and Maintenance Engineering Objectives
- Maintenance Facts and Figures
- Engineering Maintenance in the 21st Century
- Maintenance Terms and Definitions

Preventive Maintenance

- Preventive Maintenance Elements, Plant Characteristics in Need of a PM
- Program, and a Principle for Selecting Items for PM
- Important Steps for Establishing a PM Program
- PM Measures
- Mean Preventive Maintenance Time (MPMT)
- Median Preventive Maintenance Time (MDPMT)
- Maximum Preventive Maintenance Time (MXPMT)
- PM Models
- PM Advantages and Disadvantages

Engineering Services For Substations

- Content & Subdivision of Engineering Services
- Continuous Operation Readiness of E. Equipment
- The Equipment Technical State
- Technical Maintenance of Equipment
- Maintenance Main Activities
- Factors Affecting Maintenance Planning

Transformer Construction, Operation and Maintenance

- Safe areas
- Insulating Media
- Electrical Bushings
- Load Tap Changers
- Loading and Thermal Performance
- Transformer Connections
- Transformer Testing
- Load-Tap-Change Control and Transformer Paralleling
- Power Transformer Protection
- Transient-Voltage Response
- Transformer Installation and Maintenance
- Problem and Failure Investigation
- On-Line Monitoring of Liquid-Immersed Transformers

H.V. Switchgear and Underground Cables

- H.V. Switchgear Installations
- Power Circuit breakers
- Construction and Operation of Typical C.B.
- Circuit Breakers Maintenance, Inspection And Service
- Testing of High Voltage A.C. Circuit-Breakers
- Circuit Breaker Performance
- Cable Types
- Conductor and Insulating Materials
- Typical Constructions of UC
- Cables Joints
- Cable Maintenance

Troubleshooting of Three Phase System

- Identify and Repair Short Circuits Faults
- Locate and Fix Ground Faults
- Testing and Troubleshooting of Magnetic and Control Devices
- Using Electrical Troubleshooting Charts
- Troubleshoot and Repair Control Circuits and Magnetic Devices

Reading Electrical Diagrams

- American Standard Graphic Electrical Wiring Symbols
- Wiring Diagram Examples
- Identify Color Coding

ELECTRICAL DISTRIBUTION SYSTEM EQUIPMENT - PREVENTIVE MAINTENANCE

UETMT - ELEC- 126

Program Duration: 5 days

PROGRAM OVERVIEW

The program details the actions required to commission a system to confirm that it works correctly and the specification has been met. The equipment can then be put into operation with confidence.

The completion of commissioning should also trigger the start of a cycle of maintenance that will keep the system functioning in a safe manner for the expected lifetime of the installation. The program goes into detail as to how this can be achieved.

The program then examines troubleshooting concepts and methods on a variety of types of system, and concludes with a review of actions to take in emergency scenarios.

PROGRAM OBJECTIVES

This program is intended to develop knowledge of:

- Commissioning
- Maintenance
- Troubleshooting
- Emergency situations

TARGET AUDIENCE

This program is directed at managers, electrical technicians, maintenance engineers and electrical engineers who would like to expand their knowledge of preventive maintenance of electrical installations.

TARGET COMPETENCIES

- Distribution System Commissioning
- Hazardous Area Equipment
- Switch-Rooms

TRAINING METHODOLOGY

The program is conducted as modular lectures with encouragement for the delegate to interact. Case studies are included to illustrate all aspects of troubleshooting and power quality problems.
Questions are welcomed throughout the program and during break sessions.

ORGANIZATIONAL IMPACT

After attending this program, participants will have greater understanding of how to commission new systems, plan for maintenance throughout the lifecycle and troubleshoot incidents and power quality problem areas.
This is particularly relevant to sites with a high operational value that can ill-afford any downtime due to unreliabilities or lack of resilience.

PERSONAL IMPACT

On successful completion of this program, delegates will understand how:

- To develop a structured approach to commissioning and maintaining electrical distribution systems.
- To provide methods and devise solutions for electrical problems encountered during commissioning and maintenance.
- To maintain a continuing understanding of test equipment, analysers and recording systems used in maintenance and troubleshooting.
- The design, functionality and failure modes of distribution systems, protective devices and wiring.
- To consolidate and update understanding of electrical safety, procedures and current legislation.

COMPETENCIES EMPHASIZED

- How to test and commission a distribution system.
- How to troubleshoot problem areas encountered during the test process.
- Understanding of the use of monitoring equipment, analysers, probes and recording equipment.
- Understanding of protective devices and cable sizing.
- How to devise an effective maintenance regime and procedures.
- How to set up and implement a comprehensive electrical maintenance policy.

PROGRAM CONTENT

Day 1: Introduction to Commissioning

- Electrical equipment specification
- Manufacturers tests
- Pre-commissioning
- Commissioning
- Electrical Safety
- IEC 60364
- Wiring Regulations
- Maintenance
- Troubleshooting
- Personal and equipment safety
- Commissioning test methods
- Documentation

Day 2: Commissioning

- Hazardous area equipment
- Switch-rooms
- Motors
- Generators
- Switchgear
- Protection
- Cables and Transformers
- Power Electronics
- Lighting
- Earthing (Grounding) and Bonding

Day 3: Maintenance Management

- Requirements
- Stand by and Safety Services
- Planning
- Documentation

Day 4: Troubleshooting Methods

- Hazardous Area Equipment
- Motors
- Generators
- Switchgear
- Cables
- Power Transformers

Day 5: Emergency Situations

- Electrical Emergencies
- System Design
- Emergency Systems
- Priority Setting
- Communications

INTRODUCTION TO EXCITER / AUTOMATIC VOLTAGE REGULATOR (AVR)

UETMT - ELEC- 127

Program Duration: 5 days

PROGRAM OBJECTIVES

The objectives of the program in digital exciter and automatic voltage regulator (AVR) include the desire to acquaint electric power engineers and technicians with power generation systems, their digital exciters, and their voltage control. The reactive power control is also the main desire of this short program as well as the voltage control of the interconnected system. This includes a functional description of the generator digital excitation system, control, maintenance, and protection as well as the routine maintenance requirements of the system. The program will include the troubleshooting for generator excitation system.

TARGET AUDIENCE

All Engineers and Technicians involved in the Power Sectors and Power Station Operation, Control, and Maintenance, and also in the Factories, and Enterprises.

TARGET COMPETENCIES

- Generator Exciters
- Preventive, Corrective, and Predictive Maintenance

PROGRAM CONTENT

Introduction to Excitation System and Operation:

- General Background.
- Generator Exciters.
- Preventive, Corrective, and Predictive Maintenance.
- Inventory and Stock Control, Proper Storage.
- Protective Relaying.
- Over-voltages and Under-voltages Protection.
- Standard Specifications.
- H.V Current Limiting Fuses.

Generators:

- A.C. Generators.
- Single phase Generators.
- Three-phase Generators.
- Prime Movers.
- Parallel AC Generator Operation.
- Generator Stability.
- Digital Exciters.

Generator Exciters:

- Dynamic Shunt Compensation.
- Overexcited Synchronous Machines.
- Under-excited Synchronous Machines.
- Synchronous Condenses.
- Static Generator Exciter.
- Maintenance and Troubleshooting of Digital Exciter.
- Characteristics of Generator Exciter Power (GEP) Systems.
- Excitation System Analysis.
- Installation and Circuits Layout of Digital Exciter.
- Understanding Digital Circuits.
- Input and output Definitions and Programming.

Design of Thyristor Controllers:

- Thyristors.
- Thermal Consideration.
- Description of Thyristor Controller.
- An example of Thyristor Controller.

An Example of A Modern Digital Static Generator Exciter:

- Basic Arrangement
- Description of main Components
- Performance Testing

Starting Methods:

- Starting Generator Exciter
- Static Starter
- Static Design Consideration

Automatic Voltage Regulation and Frequency Control

- Voltage Regulation Operation.
- Field Inspection.
- Regulator Replacement.
- Field Control Check.

Earthing and Bonding:

- Disadvantages of Ungrounded Systems.
- Types of Grounding.
- Earthing Transformers, Current Transformers, and Voltage Transformers.

TRAINING METHODOLOGY

Each program participant will receive a copy of the comprehensive program notes. The instructor will discuss the topics using transparences, power point, videotapes, and C.D. The program is designed to have an interactive format to maximize delegate participation. Questions and answers are encouraged throughout and at the daily sessions. Needs-based case studies and examples will be discussed in problem solving workshop sessions. This gives participants the opportunity to discuss with other delegates and presenter their specific problems and appropriate solutions.

INVENTORY OF ELECTRICAL AND MECHANICAL EQUIPMENT

UETMT - ELEC- 128

Program Duration: 5 days

PROGRAM DESCRIPTION

This highly relevant program is intended for engineers and technicians who involved in inventory of Electric and mechanical equipment, maintenance, condition monitoring, operation, and trouble- shooting. Because the methods and examples are generic, personnel from all industries will benefit.

The program can be used as an introduction to the field of inventory analysis and prevention for those wishing to specialize in this area, or as an update of the key aspects of the field for those who already work in this area.

PROGRAM OBJECTIVES

The program presents a systematic approach to periodic inventory system of electrical and mechanical equipment. The matching principles as applied to inventories. Inventory valuation and importance of an accurate valuation of inventory are presented. The program presents also pricing the inventory, Cost basis of inventory valuation, and the environment of equipment.

Concepts introduced and demonstration problem for review and solution to demonstration problem are presented in the program. In this program we consider replacement of electrical equipment which gradually wears out or subject to sudden failure.

Stock — control systems, applied to the different types of stock are important to ensuring that material is available for operation and enabling work to be valued.

Upon completion of this program, participants will gain an understanding of inventory analysis methods for all electrical and mechanical equipment. Participants will learn how electro mechanical equipment can be stocked optimally. Participants will be also instructed in condition monitoring methods and will be taught how to stock when demand rate is variable

TRAINING METHODOLOGY

Each Participant will get a copy of the comprehensive program notes. The presenter will discuss the topics using transparences, and videotape. The program is designed to have an interactive format to maximize delegate participation. Questions and answers are encouraged throughout and at the daily sessions. Case studies and examples will be discussed in problem solving workshop sessions. This gives participants the opportunity to discuss with other delegates and the presenter their specific problems and appropriate solutions.

TARGET AUDIENCE

- Electrical
- Mechanical Operation
- Production
- Maintenance Engineers
- Senior Technicians, who work in Power Utilities, Industries should be benefit from this program.
- Also, Senior Engineers should update and refresh their knowledge by attending this program

TARGET COMPETENCIES

- Periodic Inventory System
- Inventory Evaluation Methods
- Inventory of Electric Equipment

PROGRAM CONTENT

Introduction

- Meaning of Inventory
- Periodic inventory system
- Inventory Evaluation Methods.
- Inventory of Electric equipment.

Examples on Inventory and Exercise

- Estimating ending inventory.
- Control of inventories.
- Inventory of an annual physical inventory.
- Need of an annual physical inventory.
- Computer Application on Electro mechanical equipment.

Stock Control with Backlogging

- Graphical representation.
- Minimizing of sum of delivery ,stock holing, and deficiency casts.
- Derivation of formulae for batch size and maximum deficiency level.
- Numerical example and exercise.
- Derivation of the economic batch quantity (EBQ) or economic order quantity.

Electro Mechanical Equipment Inventory

- Replacement with capital reduction and Maintenance.
- Input - Output Analysis.
- Estimating ending inventory.
- Coding and decoding system.
- Maximum and minimum stock.
- JIT Philosophy of inventory.

Assignment Material

- Review Questions.
- Exercises and problems.
- Business decision case.
- Beginning inventory and ending inventory

BATTERY, BATTERY CHARGERS & UPS

UETMT - ELEC- 129

Program Duration: 5 days

PROGRAM OVERVIEW

A sudden loss of power will disrupt most business operations and could lead to undesired production down time, threaten the safety of workplace.
Where a company regards Electrical Power as critical then there will be a need for a continuous or back up power system. The installation of a UPS will provide the necessary continuity. There are however problems with these installations when there is a need for maintenance especially the use of by-pass. Power Quality compatibility problems may cause failure, which was the reason for the original UPS installation.
The program is intended to develop knowledge of the need for a UPS, types available, UPS components, batteries, maintenance and troubleshooting.

PROGRAM OBJECTIVES

By the end of the program, participants will gain a full scale understanding of the following:

- The reasons for benefits of UPS and its Battery System.
- What is meant by Critical Loads and the benefit of securing these Loads with UPS.
- The principle of Operation of the UPS.
- Identify the main parts of UPS System.
- Identify the main types of UPS.
- Perform Maintenance, Testing and Troubleshooting of UPS.
- The different types of UPS batteries.
- Perform maintenance and Testing of Lead Acid and Nickel Cadmium batteries.
- Understand the performance Test of Lead Acid and Nickel Cadmium batteries.
- Identify the relevant Hazards and apply safe working practices for UPS's and Batteries.

PROGRAM LEARNING OUTCOMES

- Comprehensive understanding of principles and Construction of UPS System.
- Maintenance and Testing of UPS System.
- Have an appreciation of Electric Power System Problems and Power Quality Analysis.
- The necessary safe procedures and work practices relating to UPS's and Batteries.

TARGET AUDIENCE

- This program is designed for Electrical Engineers, Technicians, Maintenance Professions involved in the field of application which highly recommend a continuous Power Supply.
- The program is based on multi-disciplinary approach, which includes all personnel from Operators, Technicians, Supervisors, New graduated to Senior Engineers.

TARGET COMPETENCIES

- UPS
- Power System
- Electrical Disturbances

PROGRAM CONTENT

Day 1:

Course Pre-assessment

Batteries

- Introduction
- Original voltaic cell
- Primary Cells
- Secondary Cells
- Charging & discharging Batteries
- Different types of Commercial Batteries & Performance comparison.
- Battery selection & sizing
- Maintenance requirements & tools
- Storage, Preparation & installation of new batteries
- Battery Maintenance & care
- Workshop Discussion

Day 2:

- Battery Chargers DC Power Units
- Introduction
- DC Supply systems
- Types
- Control, alarms, indication & operation modes D C Power supply unit
- DC Supplies for other purposes
- Other DC Sources
- Battery charging.
- Workshop Discussion

Day 3:

- Power System Introduction
- Electrical Disturbances
- Critical Loads
- Power Electronic Component General Introduction
- UPS System General description
- UPS System block diagram
- Principle of Operation
- Types of UPS
- Main Components (Rectifier, Batteries, Inverter…)
- UPS mode of Operation
- UPS Specification
- Selecting an UPS
- Workshop Discussion

Day 4:

- Static UPS System ratings and size selection
- Rotary UPS System ratings and size selection
- UPS Configuration and Redundancy
- DC UPS principle and construction
- DC UPS industrial applications
- Workshop Discussion

Day 5:

Operation, Maintenance and Troubleshooting

- Description and Operation
- Operating Instructions & System start up
- Routine & Periodic Maintenance
- Records and Fault Diagnosis
- Electrical Safety rules to work on Batteries & UPS.
- Workshop Discussion
- **Course Post- assessment**

DESIGN REPAIR, MAINTENANCE, SETTING, CALIBRATION AND TESTING OF VARIOUS PROTECTION RELAYS

UETMT - ELEC- 130

Program Duration: 10 days

PROGRAM OBJECTIVES

- Basic design principles and components of protection
- Maintenance, calibration and testing if various relays

TARGET COMPETENCIES

- Design of Relay Protection
- Protective Relays Classification
- Current And Voltage Transformers

PROGRAM CONTENT

Introduction

- Basic design of relay protection
- Nature and cause of fault
- Consequences of faults
- Fault statistics
- Essential quantities of protection as reliability, selectivity, fastness of operation and discrimination
- Primary and pack up protection
- Basic principles of operation of protective system

Discrimination

- Methods of discrimination
- Methods of to fault location
- Discrimination by combinations of methods sensitive to location and type of fault.

Protective Relays Classification

- Introduction disk relays (shaded pole- torque control)
- Electromagnetic attraction relays
- Hanged armature relays (target and seal in unit- instantaneous unit- multi contact relay)
- Plunger or solenoid relay

Current and Voltage Transformers

- Construction
- C/T design
- Transformer polarity
- Burden
- Calculation of transformer burden
- Dangers with open circuited current transformers
- Specifications of current transformers
- Rated secondary current
- Voltage transformer accuracy
- Protection
- Residual connection
- Capacitor voltage transformers

Over Current Protection

- Basics of over current protection
- Over current protection relays
- Instantaneous protection

- Inverse time over current
- Setting of an inverse time over current relays
- Combined inverse time over current and instantaneous relay
- Inverse and definite minimum time (IDMT)
- Very inverse and extremely inverse over current
- Voltage restrained over current

Differential Protection

- Principles
- Circulating current principles
- Voltage distribution
- Three phase protection
- Source of errors

Earth and Leakage Protection

- Grounding
- Unrestricted earth fault protection
- Earth fault with over current
- Earth leakage
- Earth leakage circuit breakers
- Restricted earth fault protection

Unbalanced Loading Protection (Negative Sequence)

- Negative phase sequence
- Symmetrical components summary
- Setting consideration

Loss of Excitation Protection

- Capability curves
- Loss of field detection
- Protection against loss of excitation

Generator Typical Protection

- Types of relays
- Relay test sheets
- Using relay testers

OPERATION & MAINTENANCE OF PROTECTION RELAY

UETMT - ELEC- 131

Program Duration: 5 days

TARGET COMPETENCIES

- Protective Relaying, Control and Metering
- Preventive Maintenance

PROGRAM CONTENT

Protective Relaying, Control and Metering

- Instrument Transformers
- Intelligent Electronic Devices (IED)/Protective Relays
- Advantages of Modern Microprocessor Based Relays
- Network Communications for Electrical Installation
- Computer Based Control Systems/SCADA Systems
- Sequence of Events and Fault Recording
- Metering Monitoring Systems
- Power Quality Measurements
- Integration of Protection, Control and Metering Systems
- Case Study

Preventive Maintenance

- Setting up a Preventive Maintenance Program
- Scheduling/Monitoring
- Budgeting/Cash Control
- Safety Considerations

Life Extension of Switchgear Control Equipment

- Electrical Equipment Life
- Limits
- Mode of Failure
- Tests
- Diagnostic and Deterministic Procedures
- Equipment Life Extension Options: Replace, Rebuild, Retrofit
- Comparisons between Interrupting Technologies: Oil, Air, sf6 and Vacuum
- Typical Installation Considerations
- Application considerations

Case Study - Protection Relays

A discussion will follow the presentations of the case study. Participants will be drawn out to take part in the discussion.

ELECTRICAL ENGINEERING PRACTICES FOR SURFACE FACILITIES

UETMT - ELEC- 132

Program Duration: 5 days

PROGRAM OVERVIEW

This program is a comprehensive application of basic electrical engineering practices and functions. Attendees should have taken E-3 *Electrical Engineering Fundamentals* or have a good working knowledge of electrical fundamentals. Attendees will gain a familiarity with the requirements for sizing, selection, and specifying electrical equipment as applied in the oil and gas industry. The program will be extremely helpful to individuals who require application of electrical principles and equipment to better perform their primary responsibilities.

This five-day format presents a practical understanding of electrical systems in an interesting, effective, and efficient manner. The course emphasis is on learning the functions of electrical engineering by solving practical design and application examples in the classroom.

This program is the next level beyond an introduction to electrical engineering. Its purpose is to develop an understanding of the applications of electrical engineering fundamentals at the engineer's level. Emphasis is on the applications associated with upstream oil and gas processing facilities. The course focuses on field applications, and includes classroom exercises, fundamental engineering problems, and is based on actual field applications.

PROGRAM OBJECTIVES

- Size, select, and prepare bid specifications for major equipment for electrical systems
- How to perform simplified short circuit calculations
- To determine protective relaying needed for different types of electrical equipment
- Apply industry accepted practices for installation and maintenance of electrical equipment
- Manage a typical electrical project
- Apply cost estimating guidelines for electrical projects
- Justify and prepare economic analysis for electrical projects
- Successfully work with electrical contractors and vendors

TARGET COMPETENCIES

- Electrical Engineering Practices

PROGRAM CONTENT

- Review of key equipment selection fundamentals (Area classification requirements, NEMA & IP enclosure ratings, equipment temperature classification, etc)
- Use of company internal and industry specifications and standards
- Selecting and specifying power generator sets
- Selecting and specifying transformers
- Selecting and specifying motors
- Selecting and specifying Motor Control Centers
- Selecting and specifying UPS power (batteries, chargers, invertors & emergency generators)
- Selecting and specifying electrical distribution panels
- How to perform simplified short circuit calculations,
- Determination and application of protective relaying
- Specifying installation requirements for electrical equipment
- Guidelines for preparing cost estimates for electrical projects,
- Preparation of economic analysis for electrical projects
- Managing a typical electrical project
- Guidelines for working with contractors and vendors

ELECTRICAL DISTRIBUTION SYSTEMS: OPERATION, TESTING & PROTECTION

UETMT - ELEC- 133

Program Duration: 5 days

PROGRAM DESCRIPTION

With the ever-increasing need to dispatch electric energy to growing loads, existing distribution systems grow and expand. As well, new networks are constructed in the new developing residential, industrial and agricultural areas. Thus, large investments are spent to construct a distribution system, such that in typical power systems, 40% of the investments are spent in the distribution system which is double the investment in the transmission system (20%) and as much as the investment in the generation plants (40%). In addition, the consumers are now progressively interested in power quality and an uninterrupted supply, i.e. a reliable distribution system is required.

Therefore, system engineers in the Power Utilities progressively give every care to the distribution system operation, testing and protection.

PROGRAM OBJECTIVES

This program is, thus, devoted to develop the qualifications of Utilities Electrical Power Engineers and specialists to be capable of properly and efficiently operating and protecting a power system, with the objective of keeping the system almost free from supply disturbances and system troubles.

TARGET AUDIENCE

In general, electrical power engineers, supervisors and qualified distribution system technicians can take part in this program.

TARGET COMPETENCIES

- Electric Power Distribution Systems
- Distribution Substation
- Distribution Transformers

PROGRAM CONTENT:

General Introduction to Electric Power Distribution Systems

Design Principles Common to all Types of Distribution Systems

Classification of Distribution Systems According to:

- Voltage Level.
- Configuration.
- Degree of Automation.
- Required degree of Supply Continuity.

Principle of Operation, Construction and Performance Indices of main Components of Distribution Systems:

- Distribution Substation.
- Primary Distribution Systems (Overhead and/or Underground): Supply Feeders, Distribution Centers (Distributors), Distribution Feeders and Laterals.
- Distribution Transformers.
- Secondary Distribution Systems: Main and Sub-main Distribution Switchboards, Distribution Networks

Protective Equipment of Distribution Systems:

- Protective Relays
- Automatic Circuit Breakers
- Fuses
- Load-Break Switches and Ring-main Units

Distribution System Protection:

- Distribution Substation Protection.
- Primary Distribution System Protection.
- Secondary Distribution System Protection.
- Coordination of Protective Systems of Primary and Secondary Distribution Systems.

Supervision, Tele-metering and Tele-control in Distribution Systems

Testing Procedures of Different Components of Distribution Systems

Common Failures of Main Components of Distribution Systems

Fault Location on Overhead and Underground Feeders and Distributors

Conclusion

ELECTRICAL EQUIPMENT IN HAZARDOUS AREAS AND CLASSIFICATION

UETMT - ELEC- 134

Program Duration: 5 days

PROGRAM INTRODUCTION

- Preventing the unintentional ignition of explosive atmospheres is a critical safety and economic aspect of all petroleum and chemical plant operations. In this program you will learn how to:
- Identify and quantify the hazardous areas
- Select appropriate electrical equipment and instruments for those areas
- Recognize the different methods of protection Ex d Ex i etc. and how they work
- Install, inspect and maintain the certified equipment

TARGET AUDIENCE

- This five day program is a single and comprehensive training package which involves a combination of formal lectures, practical exercises, demonstrations and written exercises. It is primarily aimed at:
- electrical, instrument and safety craftsmen or managers
- It is assumed that most attendees will be familiar with industrial electrical practice although specific prior knowledge of hazardous areas is not a prerequisite

TARGET COMPETENCIES

- Industrial Fires and Explosions
- Area Classification
- Equipment Inspection

PROGRAM OBJECTIVES

Participants attending the program will:

- Provide a clear understanding of hazardous area current custom and practice with particular respect to the following:
- Defining the hazard, classifying hazard materials, understanding the nature of the risk and the necessity to eliminate sources of ignition
- The relationship between area classification and the various different types of Ex apparatus
- The relationship between electrical equipment and gas groups and temperature classes
- The installation and maintenance of the different types of equipment i.e. flameproof, increased safety, intrinsic safety etc
- The need for, and typical approach to, electrical equipment inspection
- The documentation of the hazardous area

PROGRAM SUMMARY

This program is intended to give:

- An in depth understanding of hazardous areas from the initial nature of the problem
- Some case studies of industrial accidents, through the identification and classification of the hazard, selection and use of protected equipment
- The administration of hazardous areas in terms of record keeping and certificates

PROGRAM CONTENT

DAY 1

- Introduction and History
- A brief history of Industrial fires and explosions
- Materials
- Understanding the important characteristics of hazard materials and how they behave when they are ignited. Looking at the data tables and seeing how, Flash point, boiling point, L.E.L. etc. influence our approach to the materials
- Area Classification
- A look at the techniques and the procedures that result in the formal allocations of zones zero, one and two
- Sources of Hazard, duration of release, extent of zones, calculations, nature of hazard and release characteristics

DAY 2

- Area Classification Exercise
- An exercise carried out in syndicate groups where a small plant is classified against the IP code of practice. This will give attendees a much clearer idea of what zone 0, zone1, and zone2 really mean at their own place of work
- Apparatus Groups and Temperature Classes
- How apparatus and hazard materials are matched together in terms of ignition energies, flame transmission characteristics and ignition temperatures. How groups and T Classes have changed over the years and from country to country and where to find the information to make comparisons
- Source of Ignition
- A look at some of the possible sources of ignition, e.g. static electricity, light metal termite reactions, friction etc., which can occur in hazardous areas. Also considering some of the steps which can be taken to eliminate them
- Methods of Protection
- Considering the recognized methods of protection. The fundamental concept in each case and the zones in which they may be employed
- Ex d Flameproof
- Ex i Intrinsic Safety
- Ex e Increased Safety
- Ex p Pressurized
- Ex N Type N
- Ex m, Ex o, Ex q, Ex s.
- Exercise
- A written exercise in which the relationship between zones, Apparatus groups, temperature classes and certifies electrical equipment is examined
- Ex d Flameproof
- Considering in depth the concept of Flameproof protection, how it works, how is must be installed, how it must be inspected & maintained. Looking at weatherproofing, corrosion, gaps, fasteners, etc

DAY 3

- Equipment Inspection Exercise Session 1
- Examining samples and answering questions about them
- Intrinsic Safety
- As for flameproof, an in depth look at the subject considering minimum ignition energies, associated apparatus and systems, simple apparatus, IS clean earth, floating systems, system matching, etc
- Intrinsic Safety Installation
- Segregation of cables, screens and armour, earthing and bonding, induction and invasion, creepage and clearance etc
- Increased Safety
- An in-depth look at this concept of protection making comparisons with flameproof, and stressing the vital importance of correct installation. Also looking at weatherproofing IP rating, CTI, stoppers and bolts, derating etc.
- Equipment Inspection Exercise Session 2

DAY 4

- Ex p Pressurized Apparatus
- A close examination of this method of protection, what it can be applied to, when certification is possible and how to maintain it. Where pressurized rooms fit in and how uncertified pressurized enclosures may be used in zone 2
- Type N
- A thorough examination of type N considering non-sparking, enclosed break, energy limitation, and restricted breathing concepts. Also making comparisons with the concepts of protection already covered in detail
- The Less Common Types of Protection
- A look at Ex m, Ex o, Ex q, and Ex s considering each in turn and pointing out the safety critical features. Also considering combined or dual certification and the combination of many concepts of protection into one item of equipment
- Equipment Inspection Exercise Session 3
- Labels, Marking and Certificates
- A look at the codings, certificate numbers and other essential markings on labels and certificates. Including a paper exercise to identify equipment and assess its suitability for given environment

DAY 5

- Installation, Inspection and Maintenance
- Considering the guidance of National codes of practice in terms of wiring and cabling, identification, isolation, inspections and maintenance. Examining inspection schedules and referring back to the concepts of protection to ensure that the attendees are comfortable with the inspection requirements for all types of equipment. Prioritizing repairs, i.e. which failures are immediately life threatening and which could become so in time
- Cable entries
- Considering cable and conduit entries to all types of enclosures and protection concepts. Also looking at adapters and reducers, plugs and correct selection in each circumstance
- Equipment Inspection Exercise Final session
- Legislation
- What the Law has to say, standards, certificates, codes, European directives, the HSE and how it all ties together
- Administration and Record Keeping
- Considering the records that should be kept by a company in order to manage a hazardous area installation

ELECTRICAL SAFETY CODES

UETMT - ELEC- 135

Program Duration: 5 days

PROGRAM DESCRIPTION

This highly relevant seminar is intended for electrical engineers and technicians involved in electrical safety. And those are responsible for general considerations of accident presentation.

The program can be used as an introduction to the field of fire fighting, personnel safety, machines safety and safety control for persons who are interested to work in safety area.

PROGRAM OBJECTIVES

The program presents a systematic approach to the basics of protection of electrical accidents, results from hazardous voltages and currents. It first adopts a general approach to the main accidents reasons the method of avoiding them. . Then it explains what is meant by hazardous voltages and currents Electrical injuries mechanisms through human bodies is illustrated.., different types, and its use in different electrical earthing and protection is also given .. The protection and insulation and its associated control circuit will be deeply involved in this program with some applications in industry.

Upon completion of this program, participants will gain an understanding of basic accidents and fire fighting procedures and electrical protection and insulation and its applications. Also they will be aware of first aids and how it can perform instantaneously and how it can be effective. And its application in electrical utilities and different aspects of industry. They will also gain some knowledge for how to perform simple protection procedures for fire fighting. The attendance will be familiar with most of the electrical presentation tools and first aide devices in most of their work.

TARGET AUDIENCE

- Electrical Engineers
- Senior technicians who work in the electrical control and Power Utilities
- Technicians who would like to refresh their knowledge
- Mechanical and chemical Engineers who are interested in control subjects
- Security services.

TARGET COMPETENCIES

- Electric Accidents Classifications
- Analysis of Accident Data
- Hazardous Voltages and Currents
- Electrical Codes

TRAINING METHODOLOGY

Each program participant will receive a copy of the comprehensive program notes. The presenter will discuss the topics using OHP- Data show. The program is designed to have an interactive format to maximize delegate participation. Questions and answerers are encouraged throughout and at the daily sessions. Needs based case studies and examples will be discussed in problem solving workshops sessions.

This gives participants the opportunity to discuss with other delegates and the presenter their specific problems and appropriate solutions

PROGRAM CONTENT

General Considerations of Accident Presentation

- Definitions
- Electric accidents classifications
- Analysis of accident data
- Statistical analysis of accidents
- Electrical injuries

Electrical Injuries Mechanisms through Human Body

- Mechanisms
- Respiratory System Failure
- Alertness Factor
- Current Path

Affected Organisms

- Environmental Factors
- Nervous System
- Living Tissues
- Human Electrical Resistance

Hazardous Voltages and Currents

- Voltage
- Current
- Frequency

Electrical Codes

- IEEE
- SCC
- QMP
- CEC

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NO/CODE	COURSE TITLE	COURSE DURATION
UETMT- MEC- 101	MECHANICAL FAILURE ANALYSIS AND PREVENTION	5 days
UETMT- MEC- 102	ADVANCED TROUBLESHOOTING OF ROTATING EQUIPMENT	5 days
UETMT- MEC- 103	PREDICTIVE MAINTENANCE & DIAGNOSTICS OF PUMPS & COMPRESSORS	5 days
UETMT- MEC- 104	PUMPS & COMPRESSORS: PREDICTIVE MAINTENANCE & DIAGNOSTICS	5 days
UETMT- MEC- 105	API 579 FITNESS FOR SERVICE OF PIPING, VESSELS & TANKS	5 days
UETMT- MEC- 106	AIR & GAS COMPRESSORS	5 days
UETMT- MEC- 107	BEAM PUMPS	5 days
UETMT- MEC- 108	GAS & STEAM TURBINES	5 days
UETMT- MEC- 109	GAS TURBINE OPERATION AND MAINTENANCE	5 days
UETMT- MEC- 110	CENTRIFUGAL COMPRESSOR TROUBLESHOOTING AND FAILURE ANALYSIS	4 days
UETMT- MEC- 111	OPERATION & MAINTENANCE OF ROTATING EQUIPMENT	5 days
UETMT- MEC- 112	ROTATING EQUIPMENT DESIGN	5 days

MECHANICAL FAILURE ANALYSIS AND PREVENTION

UETMT - MEC- 101

Program Duration: 5 days

PROGRAM OVERVIEW

To prevent the causes of Mechanical Failure Analysis and Prevention at the work site and providing participants with good knowledge of maintenance problems and practical way of solving

TARGET AUDIENCE

- Senior Maintenance Engineers, Maintenance Engineers and Equipment Support Engineers

PROGRAM OBJECTIVES

- Maintenance Philosophy and Strategy
- Maintenance Information System
- Causes of Equipment Failures
- Modes of Failures
- System Effectiveness
- Problems Solving Methods
- Condition Monitoring Technique
- Equipment Condition Based Workshop.

PROGRAM CONTENT

Day 1:

Maintenance Philosophy and Strategy

- Breakdown Maintenance
- Preventive Maintenance
- Predictive Maintenance
- Proactive Maintenance

Maintenance Information System

- Cost Control
- Investment to reduce Costs

Day 2:

Causes of Failures

- Deficiencies in Design
- Deficiencies in Material
- Deficiencies in Processing
- Errors in Assembly
- Improper Service Condition
- Inadequate Maintenance

Life Characteristics Pattern

- Early Failures
- Chance Failures
- Wear-out Failures

Modes of Failures

- Catastrophic Failures
- Degradation (Creeping) Failures
- Failure Rate
- Root Cause of Failure Analysis

System Effectiveness (Assurances)

- Availability
- Reliability
- Maintainability
- Reparability
- Serviceability

Day 3:

- Problems Analysis and Decision Making
- Problem Solving Methods
- Action to take in case of various Emergencies
- Methods to keep the equipment at best Performance

Day 4:

Condition Monitoring Technique

- Vibration Characteristic
- Misanalysis Program
- Detection
- Analysis
- Corrector

Day 5:

- Case Studies

ADVANCED TROUBLESHOOTING OF ROTATING EQUIPMENT

UETMT - MEC- 102

Program Duration: 5 days

PROGRAM OVERVIEW

This Advanced Program for industry aims to convey the latest thinking and best practice of machinery vibration monitoring and analysis via lectures, case studies, video films, and friendly software and program activities. The program gives a detailed advanced treatment of the detection, location and diagnosis of faults in rotating and reciprocating machinery, using vibration analysis. Industrial case study examples are used throughout the programme to emphasise key points and to underline the relevance and applicability of the topics being addressed.

The program will provide a refreshment of knowledge for existing condition monitoring practitioners, and it will provide a solid foundation for technologists moving into a machine monitoring and diagnostic role.

TARGET AUDIENCE

- Engineers and Technicians working in application and Management of Predictive Maintenance
- Designers and Production Managers and Engineers working in Technical and design modification roles within industries

PROGRAM OBJECTIVES

- Have a detailed understanding of Advanced Time and Frequency Analysis Techniques
- Have the knowledge to assess accurately Machinery Condition
- Have acquired a knowledge of Accurate Diagnosis of Antifriction Bearings
- Have acquired a knowledge of Accurate Evaluation of Gear Problems
- Have acquired a knowledge of Structural Troubleshooting
- Have acquired a knowledge of Predicting Remaining Machine Life

TRAINING METHODOLOGY

Participants will learn by active participation during the programme through the use of programme materials, software demonstrations, group exercises, hands-on experience of analytical methods and discussions on "real life" case studies in their organisations.

PROGRAM CONTENT

Day 1 - Vibration Signal Processing and Assessing Condition

- Sampling, Aliasing, Digitising
- Time, frequency and modal domains
- Time & Frequency Representation
- Frequency domain instrumentation
- Fast Fourier transforms
- Windowing
- Filtering
- Averaging
- Amplitude Scales
- Transmission Path Effects
- Harmonic, periodic, random motion
- Generated and excited frequencies
- Frequencies caused by electronic phenomena
- Relationship between velocity, displacement and acceleration
- Band selectable analysis and real time bandwidth
- Speed and load adjusted sensitivity
- Identifying imbalance; bent shaft; soft foot; looseness; horizontal, vertical, offset, and angular misalignment; noise; resonance; rubs; oil whirl
- Case studies

Day 2 - Advanced Analytical Techniques

- Principles of the envelope
- Pulse trains and line spectra
- Loaded element modulation
- Definitions of the ceptrum
- The autocorrelation function and coding the cepstrum.
- Comparison with spectrum and phase sensitivity.
- Transmission path effects.
- Zoom Cepstra and noise level effects.
- Dynamic range limitations and the effect of filter bandwidth.
- Other Demodulation Techniques
- Use of phase in Diagnostics
- Case Studies

Day 3 - Advanced Troubleshooting of Anti-friction Bearings

- Data Collection and Transducer Selection
- Frequency Calculation
- Identifying (inner and outer race; multiple defects; defect severity; nature of defect; deep fatigue spalls; shallow flaking; frosting; acid etching/corrosion; fluting) defects
- Defects on balls/rollers and cage
- Inadequate Lubrication
- Looseness; Excessive Internal Clearance; Turning on the shaft; Loose in the Housing
- Case Studies

Day 4 - Advanced Troubleshooting of Gearboxes

- Transducer Selection
- Gear Vibration Theory
- Gearmesh Frequency; Harmonics and Sub-harmonics
- Hunting Tooth Frequency
- Planetary Gears
- Gear Life Expectancy
- Identifying Eccentric Gears; out-of-round; bent shaft; loose; worn; misaligned; backlash problems; oscillating gears; broken, cracked or chipped teeth
- Case Studies

Day 5 - Advanced Diagnostics and Structural Troubleshooting

- Vibration Control (transmissibility, excitation, design charts)
- Fundamentals of isolator selection/damping applications
- Structural supports Considerations
- Critical Shaft Speeds
- Vibration in Ducts
- Vibrational control via structural modification
- Electric motor analysis; out-of-magnetic centre; broken rotor bars; turn to-turn shorts; siren effect
- Steam Turbines
- Pumps, Starvation and Cavitation
- Special tests; start-up/coast down; bump tests; noise recording; synchronous time averaging (STA); relative motion measurements (RMM)
- Dual-channel impact testing
- Modal analysis (Natural frequency/mode shape/damping)
- Start-up/coast-down testing
- Critical speeds/damping
- Operational Deflection Shapes
- Case Studies

PREDICTIVE MAINTENANCE & DIAGNOSTICS OF PUMPS & COMPRESSORS

UETMT - MEC- 103

Program Duration: 5 days

PROGRAM OVERVIEW

Pumps and Compressors are generally critical machines in any production process, and hence it is vital that maintenance is most effective for these units. This course aims to provide delegates with a comprehensive understanding of how to use a combined predictive and preventive maintenance approach to achieve maximum reliability and greatest understanding of any deterioration that may occur.

TARGET AUDIENCE

Engineers, Supervisory and Technical Staff involved in the Monitoring, Predictive Maintenance and Diagnostics of Pumps and Compressors.

PROGRAM OBJECTIVES

The program assumes familiarity with the design and construction of pumps and compressors. From this starting point it adopts an analytical approach to understanding the failure of all types of pumps and compressors.

From a component-by-component perspective, the program investigates the root causes of failure, and relates these to operating conditions and process parameters. Design, installation, lubrication and wear related failure mechanisms are identified and a detailed understanding of the troubleshooting and diagnostic methods needed to detect and identify these is developed.

The program provides participants with the knowledge needed to be effective in the inspection, monitoring and diagnostics of pumps and compressors, with emphasis placed upon the importance of a combined condition monitoring and strip-down inspection approach to maintenance.

TRAINING METHODOLOGY

The course is delivered in a combination of lecture style and computer-based training. In addition, a significant amount of time is set aside for small working group activity when addressing case study problems. Extensive use is made of case study material to underline the key aspects of the course and to give the delegates exposure to current best practice.

PROGRAM CONTENT

Day 1:
- Friction, lubrication and wear mechanisms.
- Adhesive wear, abrasive wear, fatigue and fretting
- Machinery life cycles
- Mechanical issues, balancing and alignment
- Statistical reliability analysis

Day 2:
- Reliability models
- The root cause of, the symptoms and the detection mechanisms for imbalance
- The root cause of, the symptoms and the detection mechanisms for looseness
- The root cause of, the symptoms and the detection mechanisms for misalignment
- The root cause of, the symptoms and the detection mechanisms for gear problems
- The root cause of, the symptoms and the detection mechanisms for bearing problems
- Cavitation, causes and prevention

Day 3:
- Anti-friction bearings: types, lifetime, mounting, applications, related problems
- Plain and pad bearings, thrust bearings: operation, maintenance, incidents
- Mechanical seals, types, operation, related problems
- Other seals for positive displacement pumps and reciprocating compressors
- Performing a balance

Day 4:
- Vibration monitoring
- Overall and spectral measurements
- Vibration limits
- Introduction to spectrum analysis
- Lubricant monitoring
- Shape, size, amount, chemical composition of debris
- Analytical techniques

Day 5:
- The role of condition monitoring in pump and compressor maintenance
- Diagnostic methods
- Capabilities and limitations of condition monitoring, and the need for a combined approach
- The importance of plant inspection
- Measurement devices, and what to monitor

PUMPS & COMPRESSORS: PREDICTIVE MAINTENANCE & DIAGNOSTICS

UETMT - MEC- 104

Program Duration: 5 days

PROGRAM OVERVIEW

Pumps and compressors are generally critical machines in any production process, and hence it is vital that maintenance is most effective for these units. This program aims to provide delegates with a comprehensive understanding of how to use a combined predictive and preventive maintenance approach to achieve maximum reliability and greatest understanding of any deterioration that may occur.

TARGET AUDIENCE

Engineers, supervisory and technical staff involved in the monitoring, predictive maintenance and diagnostics of pumps and compressors

PROGRAM OBJECTIVES

The program assumes familiarity with the design and construction of pumps and compressors. From this starting point it adopts an analytical approach to understanding the failure of all types of pumps and compressors.
From a component-by-component perspective, the program investigates the root causes of failure, and relates these to operating conditions and process parameters. Design, installation, lubrication and wear related failure mechanisms are identified and a detailed understanding of the troubleshooting and diagnostic methods needed to detect and identify these is developed.
The program provides participants with the knowledge needed to be effective in the inspection, monitoring and diagnostics of pumps and compressors, with emphasis placed upon the importance of a combined condition monitoring and strip-down inspection approach to maintenance.

PROGRAM CONTENT

DAY 1

- Friction, lubrication and wear mechanisms
- Adhesive wear, abrasive wear, fatigue and fretting
- Machinery life cycles
- Mechanical issues, balancing and alignment
- Statistical reliability analysis

DAY 2

- Reliability models
- Root cause of, symptoms and detection mechanisms for imbalance
- Root cause of, symptoms and detection mechanisms for looseness
- Root cause of, symptoms and detection mechanisms for misalignment
- Root cause of, symptoms and detection mechanisms for gear problems
- Root cause of, symptoms and detection mechanisms for bearing problems
- Cavitation, causes and prevention

DAY 3

- Anti-friction bearings: types, lifetime, mounting, applications, related problems
- Plain and pad bearings, thrust bearings: operation, maintenance, incidents
- Mechanical seals, types, operation, related problems
- Other seals for positive displacement pumps and reciprocating compressors
- Performing a balance

DAY 4

- Vibration monitoring
- Overall and spectral measurements
- Vibration limits
- Introduction to spectrum analysis
- Lubricant monitoring
- Shape, size, amount, chemical composition of debris
- Analytical techniques

DAY 5

- The role of condition monitoring in pump and compressor maintenance Diagnostic methods
- Capabilities and limitations of condition monitoring, and the need for a combined approach
- The importance of plant inspection
- Measurement devices, and what to monitor and where

API 579 FITNESS FOR SERVICE OF PIPING, VESSELS & TANKS

UETMT - MEC- 105

Program Duration: 5 days

PROGRAM OVERVIEW

The participant will learn to apply the rules of Recommended Practice API 579 "Fitness-for-Service" to recognize degradation mechanisms, evaluate the integrity and remaining life of tanks, pressure vessels, piping systems and pipelines, make cost effective run-or-repair decisions, and select the appropriate repair options. In this programme you will learn:

- Fundamental principles of fitness-for-service, their practical application through case histories, and a step-by-step evaluation process for each type of degradation mechanism
- Fundamental principles of component integrity, application of the ASME code rules, material properties of strength and toughness, and the introduction to stress and fracture mechanics
- A review of degradation mechanisms and the application of API 579 to brittle fracture, general metal loss, local wall thinning, pitting, blisters and laminations, mechanical defects (dents, gouges, misalignment, and distortion), crack-like flaws (stress corrosion cracking, weld flaws, crack-like defects), fatigue, and fire damage

TARGET AUDIENCE

- Design and system engineers
- Inspectors, project and maintenance engineers who are personally responsible for the reliable design, operation, maintenance and repair of equipment, systems, tanks, vessels, piping and pipelines

PROGRAM OBJECTIVES

Participants attending the program will learn:

- Latest techniques to determine the fitness-for-service of operating tanks, vessels, piping systems and pipelines; and make cost-effective run-or-repair decisions based on the principles of API recommended practice 579 "Fitness-for-Service"
- Balanced approach between the fundamental technical principles of structural integrity, stress and fracture analysis, and their practical application to field conditions
- Provides the participants with the tools necessary to recognize and assess defects in tanks, vessels and piping
- Presents and applies the fundamentals rules of the ASME code to operating equipment and systems
- Introduces the participants to the practical application of the ASME and API rules for structural integrity of static equipment and pipelines, and their use to assess remaining life
- Applies API recommended practice API 579 "Fitness-for-Service" through practical examples to analyse degraded conditions and make cost-effective repair or use-as-is decisions
- Applies the step-by-step 3-level approach of API 579 to evaluate inspection results and recognize potential failure modes
- Technical basis for reliability-based (risk-based) evaluation of remaining life.
- Latest developments in defect assessment techniques, starting with simple rules (level 1) and progressing to the more comprehensive evaluation techniques (level 3)
- Participants will be able to evaluate the structural integrity of corroded or damaged equipment, and assess their remaining life. Degradation mechanisms include: brittle fracture, general metal loss, local wall thinning, pitting, blisters and laminations, mechanical defects (dents, gouges, misalignment, and distortion), crack-like flaws (stress corrosion cracking, weld flaws, crack-like defects), fatigue, and fire damage

PROGRAM CONTENT

DAY 1 – FOUNDATIONS OF FITNESS-FOR-SERVICE ASSESSMENT

- Overview of ASME and API codes and standards with historical background
- Overview of API 579 contents, objectives and applications
- How to apply API 579 for cost-effective run-or-repair decisions
- Fitness-for-Service assessment procedure
- ASME code rules and design equations tanks, vessels, piping and pipelines
- Inspection techniques for tanks, vessels, piping and pipelines
- Difference between flaw acceptance criteria for new construction and in-service equipment
- Case history study and practical exercises

DAY 2 – CORROSION AND FRACTURE

- API 579 Chapter 3 assessment of existing equipment for brittle fracture
- Understanding and classifying corrosion mechanisms
- API 579 Chapter 4 Assessment of general metal loss
- API 579 Chapter 5 Assessment of Local Metal Loss
- ASME B31G Assessment of local metal loss in pipelines
- RSTRENG Assessment of local metal loss
- Repair techniques for general and local metal loss
- Case history study and practical exercises

DAY 3 – PITTING AND MECHANICAL DAMAGE

- API 579 Chapter 6 Assessment of pitting corrosion
- API 579 Chapter 7 Assessment of blisters and laminations
- API 579 Chapter 8 Assessment of weld misalignment and shell distortions
- ASME B31.4 and B31.8 Assessment of dents and gouges
- Future ASME B31 rules for assessment of pipelines defects
- Repair techniques for pitting corrosion
- Repair techniques for dents, gouges and mechanical damage
- Case history study and practical exercises

DAY 4 – FRACTURE AND CRACK-LIKE FLAWS

- Understanding crack-like flaws in base material and welds
- Introduction to fracture mechanics
- Reference stress solutions
- Understanding and estimating residual stresses
- API 579 Chapter 9 Assessment of crack-like flaws
- Fatigue mechanisms, remaining life and fatigue failure
- Repair techniques for crack-like flaws
- Case history study and practical exercises

DAY 5 – APPLICATIONS

- Exercise 1 – Brittle fracture example
- Exercise 2 – General corrosion example
- Exercise 3 – Local corrosion example
- Exercise 4 – Pitting corrosion example
- Exercise 5 – Lamination defect example
- Exercise 6 – Pipeline dent example
- Exercise 7 – Crack flaw in weldment
- Conclusion: practical application and cost benefits

AIR & GAS COMPRESSORS

UETMT - MEC- 106

Program Duration: 5 days

PROGRAM OVERVIEW

This course was designed to address the basics, concepts and Standards of Air & Gas Compressors and how practically use & maintain them properly

PROGRAM OBJECTIVES

It is vital importance for the rotating Equipment Maintenance Engineers and Technicians to get acquainted with the working principles and the function of the Compressors parts, so they can maintain them properly.

TARGET AUDIENCE

Mechanical Engineers And Technicians

PROGRAM RELATED STANDARDS

Compressor Standard

PROGRAM ASSESSMENT

Pre & Post Test to be conducted before and after the course.
Action Plan for each participant
Evaluation to be conducted after the course at last day

PROGRAM CONTENT

Day 1:
- Basic concept and definition.
- Compressor working Procedure.
- Type of Compressors.
- Centrifugal Compressor (Theory, Characteristics, Operation).

Day 2:
- Axial Compressor (Theory, Characteristics, Operation).
- Ejectors.
- Reciprocating Compressor (Theory).
- Single acting and double acting Reciprocating Compressor.

Day 3:
- Single stage and multi stage Compressor.
- Compressor Cooling.
- The application range for Compressors.
- Rotary Screw Compressor (Theory, Operation, Lubricant).

Day 4:
- Air Compressor Installation.
- Compressor Type Selection.
- Surging.
- Compressor Application.

Day 5:
- Troubleshooting.
- Compressor maintenance (daily, monthly, Semiannual, annual).

BEAM PUMPS

UETMT - MEC- 107

Program Duration: 5 days

PROGRAM OVERVIEW

Beam pumping systems are the most common method of artificial lift in the US and some other parts of the world. This course will allow the user to become familiar with the system and when it should be used. Students learn how to compare to other systems to select the best system for a given well whether it may be beam pumping or another method of lift. All components will be described in detail. Design and analysis will be done using advanced computer programs. Some films will be show mostly illustrating either new products or best practices. A few problems will be solved by the class members each day. At the end of the course the attendee will know the best applications for beam pumps and what rates can be produced from a given depth. The user will know how to combat specific problems with specific equipment used in the system. The user will know what power efficiency is, how to design a system with high efficiency and how to analyse a system to determine the current efficiency. The attendee will see how companies have kept records of operations so as to achieve constant improvement in operations.
Although computer programs are used for design and analysis, the course contains a lot of best practice which is instrumental in maintaining a profitable artificial lift program using beam pump systems. Beam pumping is said by many to be the artificial lift system of choice when it is applicable and one should have a reason for not applying the beam pump system.
Problems addressing solids, gas handling and viscosity are addressed. Best practices are stressed throughout so a long lasting system can be developed for maximum profit. SCADA controls and POC are discussed to monitor equipment loading and to achieve maximum production from a given installation.

TARGET AUDIENCE

Engineers and field technicians who are responsible for the selection, operation, and maintenance of beam pumping systems

PROGRAM OBJECTIVES

- Identify all components of the system beam pump system
- Compare designs to other artificial lift methods
- Design and analyse a system using up to date computer programs, and why different program can provide different results
- Apply best practices for longer system life Improve efficiency of the system
- Combat gas, solids, corrosion and viscosity in the produce fluids
- Combat rod compression near the pump
- Use record failures and data so as to best solve future problems

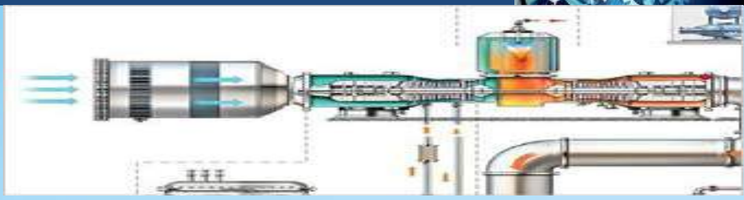
PROGRAM CONTENT

- Reservoir considerations
- Overview of artificial lift
- Design and analysis of the beam pump system
- Prime mover
- Belts
- Sheaves
- Gear box
- Unit
- Polished rod
- Wellhead/stuffing box
- Rods
- Pump
- Tubing
- Artificial lift efficiency
- Heavy oil considerations
- Gas separation/handling
- Best practices for operation
- Component design
- System analysis
- Pump off controllers

GAS & STEAM TURBINES

UETMT - MEC- 108

Program Duration: 5 days



PROGRAM CONTENT

I -Gas Turbine

Day (1):

An overview of Gas Turbine

- The Brayton Cycle
- Major gas turbine components

Gas Turbine Compressor

- Principle of operation of axial compressor
- Compressor characteristics
- Surge line and surge limit
- Surge controller

Gas Turbine Combustors

- Flame Stabilization
- Combustion and dilution
- Film cooling of the liner
- Fuel atomization and ignition
- Combustor arrangements
  - Tubular (single can)
  - Tuboannular
  - Annular
- Combustors for low emissions

Day (2):

Axial - Flow Turbines

- Turbine Geometry
  - Impulse turbine
  - Reaction turbine
- Nozzles
- Turbine blade cooling methods
  - Convection cooling
  - Impingement cooling
  - Film cooling

Gas Turbine Material

- General metallurgical behaviors in gas turbines
  - Creep and rupture
  - Ductility and fracture
  - Thermal Fatique
  - Corrosion
- Gas turbine blade materials
- Turbine wheel allays
- Coating for gas turbine material

Gas Turbine Supporting Systems

- Lubrication systems
- Cooling system
- Fuel system
- Starting system
- Intake system (Self-cleaning system)
- Compressor washing system

Gas Turbine Bearing and Seals

- Bearing types
  - Tilting - pad journal bearing
  - Thrust bearing
- Seals
  - Labyinth seal
  - Seal system

Day (3):

Gas Turbine Instrumentation and Control Systems

- Vibration measurements
- Pressure measurements
- Temperature measurements
- Control systems
  - Speed control
  - Temperature control
- Protective systems
  - Over speed
  - Over temperature
  - Vibration
  - Loss of flame
  - loss of lubrication

Gas Turbine Operating and Maintenance Considerations

- Gas turbine maintenance features
- Borescope inspection
- Major factors influencing maintenance and equipment life
  - Starts and hours criteria
  - Service factors
  - Fuel
  - Firing temperature
  - Cyclic effect
  - Air quality
- Combustion inspection
- Hot-gas path inspection
- Major inspection

Day (4):

II - Steam Turbine

Types of steam turbines

- Single cylinder turbines
- Compound turbines
- Turbine with impulse blading
- Turbine with reaction blading

Steam turbine governing systems

- Mechanical steam governor
- Electronic governing
- Over-speed protection
- Governor characteristics

Day (5):

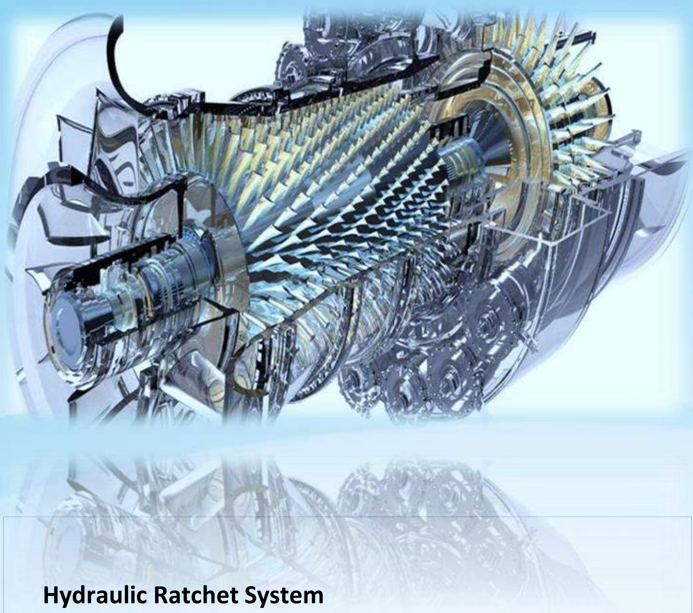
Turbine Protection Devices

- Over-speeding
- Lubrication oil failure
- High turbine exhaust pressure (low condenser vacuum)
- Governor failure
- Thrust bearing failure
- Excessive vibration
- Excessive temperature
- Turbine instrumentation
- Supervisory instrumentation
- Efficiency instrumentation
- Auxiliary system instrumentation
- Gland sealing system
- Function and system layout
- Labyrinth seals
- Temperature and pressure control

GAS TURBINE OPERATION AND MAINTENANCE

UETMT - MEC- 109

Program Duration: 5 days



TARGET AUDIENCE

Young Engineers & Technicians

PROGRAM CONTENT

Gas Turbine Fundamentals
- Bragton cycle
- Comparison between Brayton Cycle and both Otto and Diesel cycle

Gas Turbine Description
- Axial Compressor
- Turbine Section
- Casing
- Combustion System

Air Intake System
- Inlet Filtration
- Self Cleaning System
- Inlet Ducting and Silencing

Exhaust System
- Exhaust Plenum
- Transition Duct
- Silencer Modules
- Stack

Axial Compressor
- Compressor Rotor
- Compressors Starter
- Compressors Washing System

Combustion Section
- Transition Pieces
- Fuel System
- Crossfire Tubes
- Spark Plugs
- Ultra Violet Flame Detector

Inlet guide vanes

Turbine
- Turbine starter and Casing
- Turbine Nozzles
- Turbine Diaphragm
- Turbine Rotor

Hydraulic Ratchet System
- System Components
- Operation

Hydraulic Supply System
- Main Pump
- Auxiliary Pump
- Filter and Transfer Valve
- Pressure Switches

Lube Oil System
- Lubricating Oil System
- Heat Exchangers
- Oil Filters
- Pressure Regulation
- Pressure and Temperature Protection Devices
- Lubricating Oil Specification

Starting System
- Starting up Function and Sequence
- Torque Concreter Assembly
- Hydraulic Ratchet System
- Starting Clutch

Vibration Protection
- Sensors
- Alarms

Pre-start up Checks
Normal start up Procedures
Start up after Maintenance

CENTRIFUGAL COMPRESSOR TROUBLESHOOTING AND FAILURE ANALYSIS

UETMT - MEC- 110

Program Duration: 4 days

PROGRAM OVERVIEW
The participants will be gain an intensive overview of the construction, operation, control and maintenance of centrifugal compressors.

TARGET AUDIENCE
Mechanical engineers, maintenance engineers and supervisors.

PROGRAM OBJECTIVES
- Construction and mechanical aspects of the centrifugal compressor.
- Construction Features.
- Operation and control systems.
- Compressor failures
- Maintenance and Troubleshooting.

PROGRAM CONTENT
Day 1
Main components of Centrifugal Compressor
- Impellers
- Diaphrams
- Seals
- Dry seal
- Wet seal
- Labyrinths
- Balance drum
- Compressor rotar
- Bearings (radial and thrust)
- Compressor casing
- Buffer gas system
- Seal gas system
- Lub- Oil system (pumps, filters and coolers)

Day 2
Compressor Anti-Surge System
- Surge
- Surge line
- Surge limit
- Anti-surge control

Vibration Analysis
- Balancing of rotating parts
- Mis-alignment

Day 3
Compressor Maintenance
- Impellers repair and balancing
- Seal dis-assembly and installation of new seal
- Labyrinth seal change
- Maintenance of Lub-oil pumps
- Maintenance of Lub-oil coolers

Day 4
Case Study
- Analysis of failure in a Centrifugal compressor
- Failure in compressor impellers
- Failure in dry seal

OPERATION & MAINTENANCE OF ROTATING EQUIPMENT

UETMT - MEC- 111

Program Duration: 5 days

PROGRAM OBJECTIVES
To provide the operation & maintenance engineers & technicians with the means to properly operate and support the rotating equipment in a way based on the good acquaintance . with the modern technologies applied in this field . Trouble-shooting & forecasting break downs are inclusive.

TARGET AUDIENCE
Field Junior Engineers, Senior & Junior Maintenance Technicians

PROGRAM CONTENT
Technology and Operation of Rotating Machines
- General Aspects of Machine Technology
- Main Parts of the Machines : Casing, Rotor, Bearing, Coupling
- Auxiliaries : Flushing, Heating and Cooling, Lubrication Systems
- Maintenance: Assembly and Dismounting Procedures, Inspection, Clearance, Adjustment & Alignment
- Operation and Performance
- Process Aspect
- Running Parameters, Head, Flow, RPM, Efficiency
- Characteristic Curves. Regulation. Start-up, Routine Survey. Effect of internal Wear
- Mechanical Aspect
- Stress in Machines. Influence on lifetime, on Damage. Failure Prevention; Monitoring, Repair Quality
- Common Troubles
- Internal Leakages. Unbalancing. Wear and Ruptures, Vibration

Technology and Maintenance of the Machine Components
- Lubrication
- Purpose, Lube Roles, Different Types of Oil and Grease. Practical Aspect
- Bearings
- Anti-friction Bearings: Types, Lifetime, Mounting, Applications, related Problems
- Plain and Pad Bearings, Thrust Bearings; Operation, Maintenance, Incidents
- Coupling and Alignment
- Different Types of Couplings, Related Problems.
- Different Methods of Alignment using Comparators, Tolerances, Practical Aspects.
- Sealing Devices for Pumps and Compressors.
- Mechanical Pump Seals, Types, Operation, Related Problems. Installation, Geometrical Checks.
- Other Seals for Positive Displacement Pumps and Reciprocating Compressors
- Rotors and Shafts
- Balancing : Excentricity, Tolerances, Assembling on Shaft : Effect on Balancing
- Geometrical Shaft Controls

Forecasting Breakdowns
- Study of Ruptures and Wear and Other Failures
- Typical Damage to Machines: Problems and Causes of Failures, Influences of Metallurgy and Surface Treatments
- Fatigue, Wear and Tear
- Rupture Face Analysis
- Use of Vibration Surveys in Forecasting

ROTATING EQUIPMENT DESIGN

UETMT - MEC- 112

Program Duration: 5 days

PROGRAM OBJECTIVES
To enable the participants to enhance their knowledge of oil field rotating equipment design, specification, and classification of rotating equipment.

TARGET AUDIENCE
Mechanical Senior Engineers, Mechanical Engineers and Operation Engineers

PROGRAM CONTENT
Types and Classification of rotating equipment
Principles of rotating equipment
Design consideration and operation constraints
Selection criteria

Day One:
Types and classification of rotating equipment
- Power Generating Equipment
- Steam turbine
- Gas turbine
- Compression Equipment
- Centrifugal compressor
- Axial compressor
- Centrifugal Pumps

Steam Turbine
- Steam properties
- Thermodynamic of steam cycle
- Description of steam turbine and its accessories
- Design of steam turbine
- Velocity triangle and developed power
- Material of steam turbine components
- Control of steam turbine
- Governor
- Part load operation
- Troubleshooting, repair and maintenance

Day Two:
Gas Turbine
- Thermodynamic cycles of gas turbine
- Pressure ratio
- Maximum cycle efficiency
- Thermal efficiency
- Gas properties
- Gas turbine cycle
- One shaft gas turbine cycle
- Two shafts gas turbine cycle

Components of gas turbine cycle
- Axial compressor
- Combustion chamber
- Gas turbine

Design of Gas turbine
Blades of gas turbine, shape and material
- Rotor
- Stator
- Velocity triangles
- Power developed
- Gas turbine control
    - Speed control
    - Temperature control
- Troubleshooting, repair and maintenance

Day Three:
Centrifugal Compressor
- Gas Compressor
- Air Compressor
- Components of Centrifugal Compressor
    - Rotor
    - Impeller
    - Blades
    - Gas & Oil Seals
- Velocity Triangle
- Compressor Head
- Design of Centrifugal Compressor
- Consumed Power
- Surge Phenomena
- Surge Control System
- Troubleshooting, Repair and Maintenance

Day Four:
Axial Compressor
- Applications
- Components of Axial Compressor
    - Rotor
    - Stator
- Design of Axial Compressor
- Head of Axial Compressor
- Velocity Triangle
- Head per Stage
- Axial Compressor Start-Up
- Consumed Power
- Troubleshooting

Day Five:
Centrifugal Pump
- Components of Centrifugal Pump
- Material of Centrifugal Pump Components
- Head per Stage
- Design of Centrifugal Pump
- Pump Performance
- Pump Piping
- Cavitations
- System Performance
- Parallel and Series Operation of Pumps
- Mechanical Seal Selection
- Coupling
- Start-up and Priming
- Troubleshooting, Repair and Maintenance

INSTRUMENTATION & CONTROL

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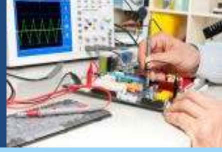
SQA Approved Centre



I&C

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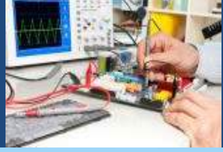
NO/CODE	COURSE TITLE	COURSE DURATION
UETMT– I&C 101	ADVANCED INSTRUMENTATION & PROCESS CONTROL	5 days
UETMT– I&C 102	DISTRIBUTED CONTROL SYSTEMS (DCS)	5 days
UETMT– I&C 103	INTRODUCTION TO DIGITAL ELECTRONICS	5 days
UETMT– I&C 104	PROCESS CONTROL AND INSTRUMENTATION	10 days
UETMT– I&C 105	P&ID, INSTRUMENTATION & CONTROL	5 days
UETMT– I&C 106	CUSTODY & CHECK METERING SYSTEMS CALIBRATION AND TROUBLESHOOTING	5 days
UETMT– I&C 107	CALIBRATION FOR PROCESS INSTRUMENTATION (LEVEL - 2)	5 days



ADVANCED INSTRUMENTATION & PROCESS CONTROL

UETMT- I&C 101

Program Duration: 5 days

PROGRAM OVERVIEW

In most of oil and gas industries, petrochemical refineries, chemical, food industries, the Process Measurement and control play the most important part in controlling fluid flow and safety of process.
The purpose of this course is to introduce the principles for instrumentation systems of Measurement, control system construction with different applications. Instrumentation for Oil & Gas industry and Process control are included for the different processes such as compressor Controls, gas turbines, boilers & Distillation column.

TARGET AUDIENCE

Instrumentation and Automatic Control Engineers / Technicians
Whose job profile including the following competences

- To maintain the Instruments Hardware components
- To troubleshoot the system (Hardware and Software)
- To configure or modify the plant logic and control loops
- To be familiar with the plant's process for maintenance /planning
- To monitor and maintain the control loop performance

Process Engineers / Technicians

Whose job profile including the following competences

- To operate and observe the plant through the instruments
- To analyze the process data for modifications and corrective actions
- To be familiar with the plant logic and control loops
- To monitor the plant performance
- To monitor and maintain the control loop performance

TARGET COMPETENCIES

- Instruments for Process Control
- Control Loop
- Control System Architecture
- Field Measurements Devices
- Control Valves

PROGRAM OBJECTIVES

By the end of the program, participant will be able to understand to

- Master the principles of instruments for process control
- Master the principles of control loop
- Master the basic control system architecture
- Be familiar with the modern system and control loop
- Link the I&C capabilities with the industrial application
- Measure the performance of the control system

PROGRAM CONTENT

Day 1:

- Pre-test
- Plant protection Layers and Safety Through Automation and importance of process measurements
- Measurement Device General Requirements
- Advanced Field Measurements Devices :-
- Flow

Day 2:

- Advanced Field Measurements Devices Continue :-
- Flow measurements continue
- Pressure
- Temperature
- Level

Day 3:

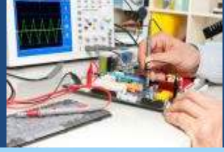
- Control Valves principles
- Control valve types
- Sliding-stem valves
- Globe valves
- Gate valves
- Diaphragm valves
- Rotary-stem valves
- Ball valves
- Butterfly valves
- Disk valves
- Control valve backing
- Control valve accessories
- Control valve Actuators Types
- Pneumatic actuators
- Hydraulic actuators
- Electric actuators
- Hand (manual) actuators
- Practical Examples and case studies for control valves
- Controlling Mode & PID Controller Algorithm
- Control loop elements
- Open-Loop Response
- Closed-Loop Response
- PID Controllers algorithm
- P control loop
- PI control loop
- PID control loop

Day 4:

- Selective type of control
- Cascade Loops
- Ratio Control,
- Split Range Selective, Override, and Limit Controls
- Feed forward Control
- Practical and case study for oil & gas
- Anti surge control
- Boiler Control
- Tuning PID Controllers
- Ziegler-Nichols
- Introduction to Distributed Control System
- Distributed Control System Hierarchy
- System Components and function of each
- Introduction to Programmable Logic Controller

Day 5:

- Safety Instrument Function and Safety Instrument System Requirements
- ICSS Operations DCS Vs. PLC & SCADA and ICSS Control System Operational Benefits
- Introduction to Gas Turbine



DISTRIBUTED CONTROL SYSTEMS (DCS)

UETMT- I&C 102

Program Duration: 5 days

PROGRAM DESCRIPTION

A distributed control system integrates the PLCs and process controllers of a process line into a coordinated, interactive system. It enables you to manage the process as a complete system, with control over the interrelationship of the various subsystems. A DCS lets you see the “big picture” and improve the overall efficiency and quality of your plant.

This program provides a view of distributed processor systems and their evolution from Distributed Control Systems (DCS) to open control systems. Participants will compare distributed control to traditional single loop, central computer, PLC, and PC architectures with a view to future directions and links into corporate-wide enterprise resource planning systems. The benefits and cost savings of Foundation Fieldbus technology compared to 4-20mA field technology are covered, as well as how Foundation fieldbus segments are put together and configured.

The program is designed to have an interactive format to maximize delegate participation. Questions and answers are encouraged throughout and at the daily sessions. This gives participants the opportunity to discuss with other delegates and the presenter their specific problems and appropriate solutions.

PROGRAM GOAL

The main goal that the program aims to achieve is to provide practical knowledge for distributed processor systems and their evolution from distributed control systems (DCS) to open control systems.

TARGET AUDIENCE

This program is intended for Engineers & highly qualified technicians working in the field of instrumentation and control in the process industries.

TARGET COMPETENCIES

- Distributed Processor Technology
- Controller Structures
- Fieldbus Terminology and Technology

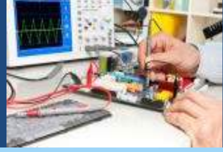
PROGRAM OBJECTIVES

By the end of the program, participant will be able to:

- Investigate latest advances in distributed processor technology using several commercial systems to illustrate the concepts.
- Analyze impact of this technology on possibilities of control strategies as well as operator interfaces.
- Apply concepts of body/mind reaction to audio and visual symbols to meaningful human machine interfaces
- Evaluate and justify potential benefits of distributed processor technology for improved productivity
- Examine how a process control strategy can evolve with changing needs.
- Reconfigure and link processor technology to enterprise resource planning systems.
- Specify, select, and implement distributed processor system.
- Realize the benefits and cost savings of Foundation Fieldbus.
- Understand how Fieldbus segments are built, including device requirements, wiring methodology, and segment configuration.
- Understand how Foundation Fieldbus compares to other industrial bus systems
- Recognize the purpose of the Fieldbus Foundation
- Understand Foundation Fieldbus interoperability and interoperability testing by the Fieldbus Foundation

PROGRAM CONTENT

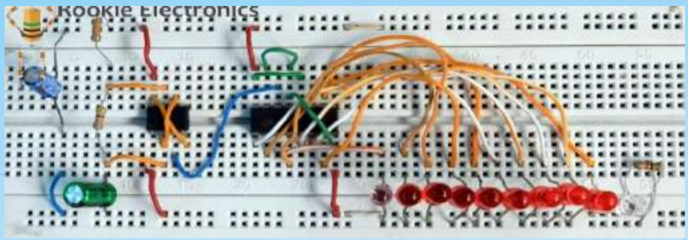
- Understanding of Distributed Computing: Distributed Analog to Central Computer to Microprocessor - Functional Distribution – Physical Distribution - Distributed and Centralized Information.
- Comparison of Current System Philosophies: Distributed Control -Programmable Logic Control - Personal Computing Networks – Open Control Systems.
- Controller Structures: Inputs/Outputs - Shared Loops - Clustered Loops - Discrete and Logic Control - Sequential and Batch Control - Multifunction Control.
- The Operator Interface: Philosophy - Workstation Roles - Operator Input Devices - Alarms – Testing.
- Communication Networks: Physical Architectures - Communicating Structures - Media Access Protocols - Fieldbus Links – Plantwide Links to MES, ERP, etc.
- Control Strategy and Configuration: Development of Control Parameters - Development of Control Strategy - Configuration Languages.
- System Security: Reliability - Availability - Redundancies - Diagnostics - Personnel Access.
- Implementation: Justification - Prepare Specification - Looking at Vendors - Evaluating Quotes - Post Purchase
- Foundation Fieldbus terminology and technology
- Foundation Fieldbus H1 and High Speed Ethernet (HSE)networks
- Comparison of other industrial bus protocols
- Cost savings and operational benefits of Foundation Fieldbus technology
- Configuration and operation of a Foundation Fieldbus H1 segment
- Wiring of a Foundation Fieldbus Hi segment
- Looking to Future Changes: Technologies - System Structures - Process Performance.
- Distributed Control System Reporting.
- Maintenance Consideration.



INTRODUCTION TO DIGITAL ELECTRONICS

UETMT - I&C 103

Program Duration: 5 days



PROGRAM OBJECTIVE

By the end of the program, the participants will be able to:

- Demonstrate the Construction of Cables
- Know How to make a H.V Terminals and Joints
- Simply Calculate a Voltage Drop
- Carry Out Maintenance and Testing for Power Cables

PROGRAM COMPETENCIES

- Electrical Conductors
- Cables, Cable Ampacities and Voltage Drop Cables
- High Voltage Cables

PROGRAM CONTENTS

ELECTRICAL CONDUCTORS

- Conductor Materials
- Wire Measurements, U.S. Customary System
- The American Wire Gauge
- Wire Measurements, SI Units
- Stranded Wire
- Resistively
- Temperature Coefficient of Resistance

PROPERTIES OF CONDUCTORS

- Electrical Wire and Cable Terminology
- Classification of Wires or Cables
- Classification according to Degree of Covering
- Material and Make-up of Electrical Conductors
- Cable Assembly
- Electrical Shielding
- Fillers
- Binder Tapes
- Insulation of Electrical Conductors
- Rubber Insulation
- Code-grade Rubber Compound
- Thermoplastic Insulation
- Thermosetting Insulation
- Mineral Insulation
- Paper Insulation
- Protective covering Materials
- A Pure Lead Sheath
- A Reinforced Lead Sheath
- An alloy Lead Sheath
- Flat band Armour
- Interlocked Armour
- Wire Armour
- Basket Weave Armour
- MI (mineral insulated) Cable

CABLES, CABLE AMPACITIES AND VOLTAGE DROP CABLES

- General
- Power Cables
- General Construction
- Conductors
- Insulation, Covering and Stress Relief
- Cable Stress Relief
- Bedding
- Armouring
- Outer Sheath
- Selection of Power Cables
- Control Cables
- Mineral Insulated Cables
- Method of Specifying Cables

Basics of Digital and Analog Systems

- Analog Electronics
- Binary World
- Digital Process
- Batch, Discrete, Digital Systems

Electronic Devices

- Transistors
- FETs.
- Op Amp
- MOSFETs

Digital World

- Definition
- Classification
- Selection.
- Gates
- Number Systems

Digital Logics

- Concepts
- Combinational Logics
- Sequential Logics
- Logic Families
- Logic Tools

Digital Devices

- Flip Flops
- PLDs
- Counters
- Shift Registers
- Memories
- Digital Communication

Digital Interfacing

- Analog /Digital Converters
- Digital /Analog Converters
- Interfaces Hardware
- Interfaces Software
- Digital Computer

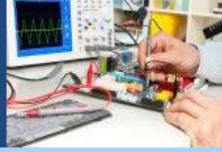
MP Systems

- MP Systems Classification
- MP Systems Errors and Tolerances
- MP Systems Performance
- MP Circuits

Advanced Technology Digital Circuits

- Dynamic Operations
- Early Forms
- TTl Families
- Gar Digital Circuits

Case Study-PSPICE Digital Simulation Program and Application



PROCESS CONTROL AND INSTRUMENTATION

UETMT- I&C 104

Program Duration: 10 days

PROGRAM DESCRIPTION

More efficient control can only be achieved through better understanding of the problem and better measurement. However, the field of process control and Instrumentation is changing at a dramatic rate. Measurements and accuracies that would have been thought of as impossible to achieve are now commonplace. But unless applied correctly, huge resources can be wasted to no avail.

PROGRAM OBJECTIVES

Upon completion of this course, participant will be able to

- The impact of modern instrumentation
- The major technologies used in the measurement of temperature, pressure, level, flow etc. Choose & Specify Instrumentation systems for pressure. Level, temperature and flow measurement.
- Evaluation and selection of the appropriate instrumentation systems
- Installation of process equipment correctly
- Identify different types of industrial analytical measuring instruments
- Procedures for testing and calibration of analytical instruments
- Troubleshoot and identify problems with instrumentation systems
- The fundamentals of process control engineering
- The effects of proportional, integral and derivative control and apply both open loop and closed loop tuning.
- The effect of different control algorithm on loop tuning
- The process loops and how this can be applied to optimize process control.
- Process measurement concepts and techniques related to control variables.
- Pressure Measurement
- Temperature Measurement
- Automatic control principles
- Flow measurement
- Level Measurement

LEARNING OUTCOMES

At the end of this training Participants will be able to:

- Introduction to process measurement
- Understand the principles of operation and the application of pressure flow temperature and level measurement devices.
- Understand the fundamental concepts of process control
- The application of instrumentation to process systems
- Process measurement concepts and techniques related to control variables.
- Pressure Measurement
- Temperature Measurement

PROGRAM CONTENT

Overview

Basic Measurement Concepts
- Measured and controlled variables
- Performance terms and specifications
- Measurement terminology
- P&ID symbols

Flow Measurement
- Basic fluid properties
- Reynolds number
- Positive Displacement Meters
- Inferential meters
- Oscillatory Flow Meters
- Differential Pressure Meters
- Electromagnetic Flowmeters
- Ultrasonic Flowmeters
- Coriolis meters

Temperature Measurement
- Basic principles
- Scales
- Expansion systems
- Thermocouples
- Resistance thermometry
- Thermistors
- Radiation thermometry

Pressure Measurement
- Basic principles
- Bourdon tubes
- Bellow elements
- Diaphragm elements
- Electrical displacement sensors

Level Measurement
- Basic principles
- Visual gauging systems
- Float systems
- Displacement systems
- Conductive level detection
- Ultrasonic level measurement
- Radar gauging

Basic Valve Theory
- Bernoulli's equation
- Defining the valve flow coefficient
- Choked flow
- Flashing and cavitations

Valve Types

Control Valve Characterization
- Inherent characteristics
- Installed characteristic
- Characteristic profiling

Valve Testing and Diagnostics

Basic Process Considerations
- Definition of terms
- Process lag, capacitance and resistance
- Process reaction curve
- 1st and 2nd order reactions

Fundamentals of Process Control
- ON/OFF control
- Proportional control
- Proportional offset
- Integral action
- Integral windup
- Stability
- Derivative action
- PID control
- Control algorithms

Testing, Fault Finding and Maintenance
- Fault finding and error handling –Damage prevention
- Sensor faults
- Actuator faults
- Errors in transmission lines
- Errors in transmitter technology
- Errors on processors
- What is meant by maintenance?
- Service
- Inspection
- Repairs
- Systematic repairs in the event of malfunction
- Prerequisite for systematic repairs
- Fault finding
- Systematic fault finding
- Fault documentation
- Fault analysis
- Final analysis
- Conclusions

P&ID, INSTRUMENTATION & CONTROL

UETMT- I&C 105

Program Duration: 5 days

PROGRAM DESCRIPTION

This 5-day course will provide participants with the principles of P&ID drawings which are used in process industries. This course is suitable for individuals dealing with P&ID's in all Process industries including Chemical, Oil & Gas, Petrochemical, Water & wastewater, and Food processing industries. A road map of P&ID during the lifetime of a design project is studied. Symbols, tagging, and basic explanations of popular items in P&ID drawings are among the topics covered and, for broader understanding, the different arrangements of each item is presented. Additionally given are some rules of thumb.

This course will cover piping, valves and control valves, tank and vessels, pumps, heat exchangers and control systems, including BPSC, SIS, and Alarm. Each individual concept is reinforced using P&ID schematics specific to the topic.

This course will cover the gap of information between the theoretical aspects of process control provided by academia and the onsite knowledge & skill gained by process control and Instrument engineers/technologists in the workplace.

For design engineers, this course provides the knowledge to design a control system by intuition, as is most commonly done by experienced engineers in regards to control loop systems within P&ID's..

This course will cover the often-overlooked plant-wide control systems; equipment-wise control system includes pipes, tank and vessels, pumps, compressors, and heat exchangers.

Three main layers of control: BPSC, SIS, and Alarm and their "carriers" (DCS and PLC) will be discussed as well, with real-life examples.

This course is suitable for individuals dealing with P&ID's in all Process industries including Chemical, Oil & Gas, Petrochemical, Water & Wastewater, and Food processing industries.

PROGRAM OBJECTIVES

Upon completion of this course, participant will be able to

- Loop Characteristics
- Laboratory and Test Equipment
- Calibration and Configuration
- Instrument Maintenance
- Installation
- Electronic Controllers
- Safety in Hazardous Locations
- Trends

TARGET AUDIENCE

This course is designed for:

- Process Engineers
- Automation and Control Engineers
- Instrumentation Engineers and Technologists
- Mechanical Engineers
- Operation leads
- HAZOP Facilitators
- Project Engineers
- Piping Designers

PROGRAM CONTENT

DAY ONE

- P&ID: Its Role, Content, and Milestones
- P&ID Anatomy & General Rules
- Provision for Ease of Maintenance
- Pipes & Fittings: Symbols, Tagging, and Arrangements

DAY TWO

- Valves: Symbols, Tagging, and Arrangements
- Control Valves: Symbols, Tagging, and Arrangements
- Containers: Symbols, Tagging, and Arrangements
    - Tanks
    - Vessels
    - Ponds

DAY THREE

- Fluid Transferring: Symbols, Tagging, and Arrangements
    - Liquid Movers: Centrifugal pumps, Positive Displacement Pumps
    - Gas Movers (briefly)
- Heat Exchangers: Symbols, Tagging, and Arrangements
- Pressure/Vacuum Relief Devices: Symbols, Tagging, and Arrangements

DAY FOUR

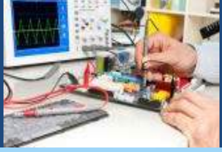
- Dealing with Ambient:
    - Heat Conservation
    - Winterization
- Operator Safety
    - Insulation for personal protection• Utilities:
    - Different Utilities and Their Applications
    - Utility Networks

DAY FIVE

- Instrumentation & Control:
    - BPCS (Basic Process & Control System)
    - Alarm System
    - SIS (Safety Interlock System)
- Loop Characteristics:
    - Current Loop • Power Source
- Laboratory and Test Equipment:
    - Multi-meter • Process Calibrator
    - Calibration and Configuration: Instrument Performance • Calibration
    - Standards • Device Calibration • Calibration Documentation
    - Instrument
- Maintenance:
    - Corrective • Preventive • Predictive
- Installation:
    - Grounding and Isolation • Plant Conditions
- Electronic Controllers:
    - Control Strategies • Controller Maintenance
    - Digital Controllers
- Safety in Hazardous Locations:
- Location Classification • Explosion
- Proofing • Purging and Pressurization • Intrinsic Safety
- Trends:
    - Personal Computers in Control • Fieldbus Technology

COURSE RELATED STANDARDS

- NFPA
- API
- National Electrical Code(NEC)



CUSTODY & CHECK METERING SYSTEMS CALIBRATION AND TROUBLESHOOTING

UETMT- I&C 106

Program Duration: 5 days

PROGRAM DESCRIPTION

The flow metering systems are provided to enhance the accurate measurements of crude oil and prevent losses due to measurement variances/errors.

PROGRAM OBJECTIVES

Upon completion of this course, participant will be able to

- The course addresses the concepts of flow transfer metering, principle of allocation in shared facilities, and the general operating principles of custody transfer instruments .
- It will also handle the common problems and the systems validation techniques.

TARGET AUDIENCE

This course is designed for:

- Maintenance Technicians
- Supervisors
- Engineers

PROGRAM CONTENT

Day One

- Introduction – In general
- Fluid Properties
- Flow Meters – Overview
- Definition of SI units and principles of traceability of measurement
- Flow Measurement
- Turbine Flow Meter
- Operation Theory
- Mass Flow Meter
- Coriolis Flow Meter- Emerson

Day Two

- Design & Construction Variations
- Turbine Meter Accuracy
- Sizing & Selection
- Plate and Senior orifice
- Orifice Types & Selection
- Orifice Performance
- Venturi & Flow tubes
- Venturi-Cone Element
- Principles of meter K-factor control
- Principles of Ultrasonic Flow meters

Day Three

- Liquid and gas custody transfer metering systems
- Proving types
- Proving – Check and Master Metering
- Relevance and general principles of meter station
- Metering Best Practices
- Principal of Operations
- Meter Curves
- Fault Analysis

Day Four

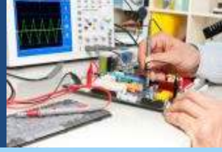
- Liquid Measurement
- Liquid Metering Techniques
- Metering Calculations
- Operations & Maintenance- Flow
- Supporting equipment
- Supervisory systems
- Common Problems
- Overview on common features of dedicated flow computers
- Function and calculation sequence of turbine meter flow computers
- Representative sampling, operation of automatic samplers
- Sampling
- Liquid Mixture equations, principles of BS & W probes

Day Five

- Water Drawing Techniques
- Gas Chromatography
- Flow meters calibration requirements
- Flow computers Function Testing
- Flow and Supervisory computers
- Density Management
- Instrument calibration
- Maintenance / Troubleshooting

APPLICATION

- Sent P & IDs will be considered and discussed during the course as an example in the Class only.



CALIBRATION FOR PROCESS INSTRUMENTATION (LEVEL - 2)

UETMT- I&C 107

Program Duration: 5 days

PROGRAM DESCRIPTION

This course offers a combination of practical information and hands-on experience, covering proper installation, calibration, and maintenance of electronic instruments. You will examine characteristics of electronic control systems; techniques for installing electronic instruments; and procedures for configuring and calibrating transmitters, transducers, and controllers.

PROGRAM OBJECTIVES

On completion of the training course, the trainee will be able to understand and apply:

- Loop Characteristics
- Laboratory and Test Equipment
- Calibration and Configuration
- Instrument Maintenance
- Installation
- Electronic Controllers
- Safety in Hazardous Locations
- Trends

TARGET AUDIENCE

This course is designed for:

- Instrument Technicians
- Electrical Technicians

PROGRAM CONTENT

- **Loop Characteristics:**
  - Current Loop
  - Power Source

- **Laboratory and Test Equipment:**
  - Multimeter
  - Process Calibrator

- **Calibration and Configuration:**
  - Instrument Performance
  - Calibration
  - Standards
  - Device Calibration
  - Calibration Documentation

- **Instrument Maintenance:**
  - Corrective
  - Preventive
  - Predictive

- **Installation:**
  - Grounding and Isolation
  - Plant Conditions

- **Electronic Controllers:**
  - Control Strategies
  - Controller Maintenance
  - Digital Controllers

- **Safety in Hazardous Locations:**
  - Location Classification
  - Explosion Proofing
  - Purging and Pressurization
  - Intrinsic Safety

- **Trends:**
  - Personal Computers in Control
  - Fieldbus Technology

OUR VISION

To ensure a competent, qualified, and highly motivated workforce focused on achieving the critical outcomes, through the Development and Administration of cost-effective and result-oriented Human Resource and Occupational Training Programs, Services, and Practices.

United Eastern Technical and Management Training is aligned with the Abu Dhabi Vision 2020 and contributes to achieve the UAE Economic Vision 2020 by promoting Social and Human Resources Development and by preparing the National workforce to serve Industrial and Technological growth in UAE.

OUR SERVICES

United Eastern Technical and Management Training is primarily involved in Oil and Gas Training & Development; Human Capital and Talent Acquisition.

United **E**astern **T**echnical and **M**anagement **T**raining delivers is a mixture of Standard Courses ranging from 1-day computing courses to customized, off-the-shelf Oil and Gas Training Programs of over a year's duration tailored to an Individual Organization's requirements. Courses may be attendance only, assessed against specific client needs or courses that lead to recognized National and/or International Qualifications.

STRATEGIC GOALS

- Build a Competent Workforce
- Build a Competency base Integrated System for Managing and Assessing Performance
- Provide Training to Transfer knowledge and Develop Skills

OUR MISSION

Is to facilitate the community and staff members of our clients towards meeting their responsibilities and tasks. Supported by a team of highly experienced specialists and maintaining an open vision for the ever changing trends and maintaining the upmost standards, United Eastern Technical and Management Training will strive to provide an unparalleled competent workforce, permanently lowering your operating costs and contributing to meeting organizational goals.

VALUES STATEMENT

We believe in demonstrated Competence, Institutional Integrity, Personal Commitment and deep sense of Nationalism.

STRATEGIC GOALS

- Define Core Curriculum based on Competencies of market Corporate needs
- Conduct ongoing Evaluations/Assessments of Programs
- Determine delivery methods and Sources
- Offer Training/Learning Opportunities to meet Organizational Needs
- Consistently align with Operations and Project Workforce Planning Requirements
- Skills Enhancement Process (SEP) for continuous Development
- Each Individual will have a Skills Enhancement Training Plan
- On-Job Learning supported by focused Technical Training

WHY CHOOSE UETMT?

- UETMT is the Number ONE choice in the provision of Competency Management Consultancy Services
- We are innovators in providing Learning Solutions to fill identified Competence Gaps
- Our team of experts bring with them a breadth and depth of experience in successful and sustainable Competency Management
- We employ the best of the best thought-leaders committed to the improvement of Competency across the Oil & Gas Industry
- UETMT is offering Complete spectrum of Training and Competency Development
- Our training is designed to create an environment and experience where you can accelerate and LIVE THE LEARNING EXPERIENCE when training others.
- Our Instructors are world-class approved trainers, with extensive experience in the Middle East.
- Our international experience working with clients in various countries has spanned from individual course delivery to complete multi-year workforce nationalization programs. We understand the needs of our multi-cultural learners especially in the oil and gas context.
- By combining expert-led courses, in-class projects customized for your asset challenges, field and lab courses that provide hands-on learning experiences, industry leading software tools, and one-on-one mentoring, UETMT training blends a targeted skills-development program that aligns your team's abilities to your strategic objectives
- UETMT works with International bodies that provide access to global standards and certification. This ensures that our products and processes match global requirements and add a level of assurance to our clients, whilst enabling them to adopt standards that provide real business benefit to them and their employees. As an example:
- UETMT is an Approved Center of the Scottish Qualification Authority (SQA), a UK Governmental Organization, offering Customized Award Programs (SVQ Level) credit rated onto the Scottish Credit and Qualifications Framework (SCQF).
- UETMT is approved by the Engineering Construction Industry Training Board **(ECITB)**, a UK organization
- **UETMT is ISO Certified by QSR**
  ISO 9001: 2008- Quality Management System (QMS)
  ISO 14001: 2004- Environmental Management System (EMS)
  OHSAS 18001: 2007- Occupational Health & Safety Management System (OHSAS)

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