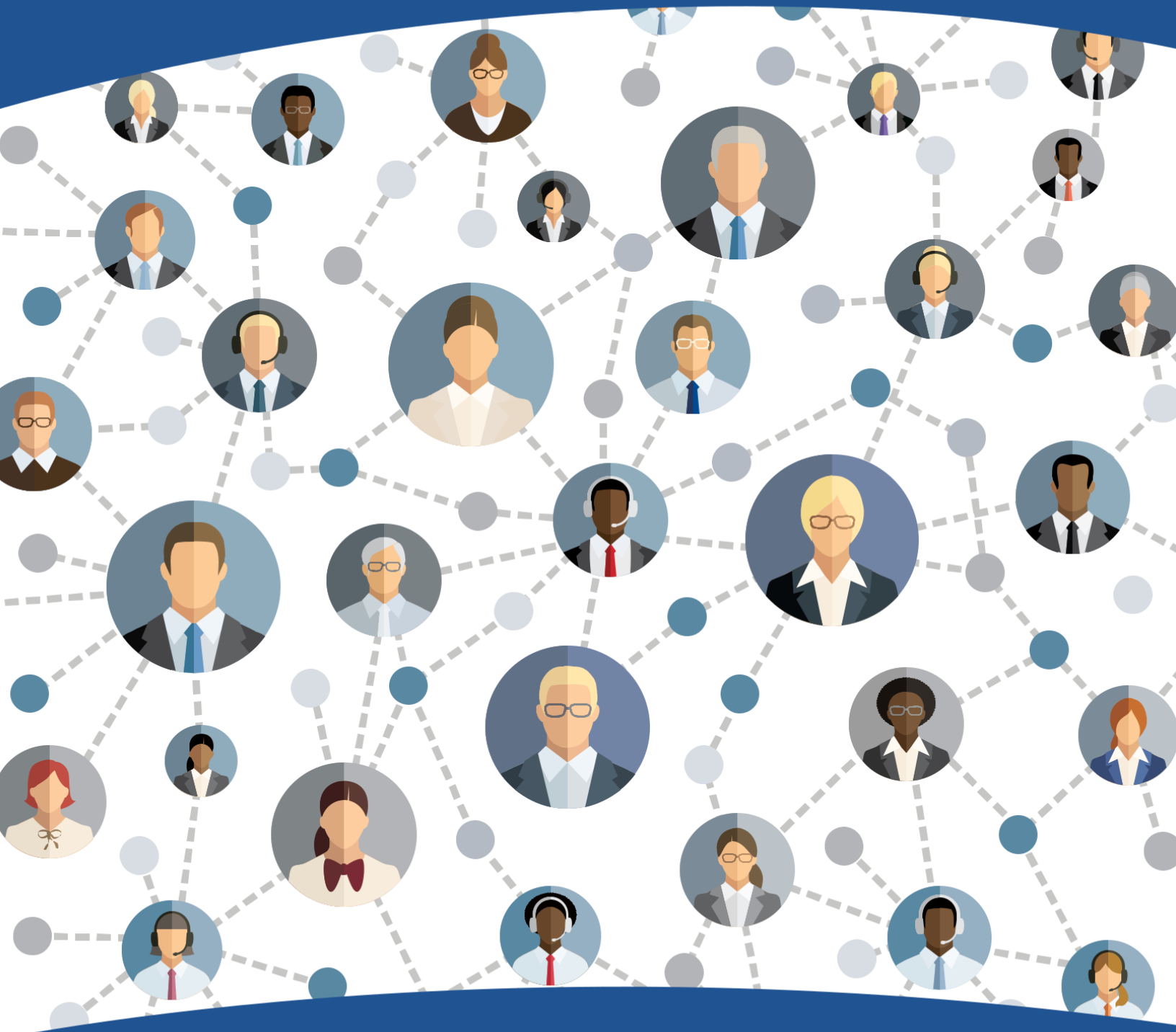
GULF INSTITUTE



WINNER OF THE AWARD FOR THE BEST TRAINING INSTITUTE IN THE GULF

Electrical Engineering Advanced Workshop

INTRODUCTION

- Electrical Engineering is research, development, manufacture, installation, operation, maintenance and management of equipment, plant and systems within the electrical, electronic, communication and computer systems. These activities can apply to electricity generation, transmission, distribution, electrical installations, electrical equipment manufacturing, instrumentation and controls systems applications, communications network, electronic plant and equipment, and also the integration and control of computer systems.
- Highly participative Electrical Engineering Advanced Workshop will help participants get clear and perfect understanding of power stations, transmission & distribution systems, and zone substations. The training will cover both primary and secondary systems. This training course seeks to provide skills such as Power system studies and case studies; Transmission systems technical considerations; LV and MV distribution system design and operation; Substation equipment selection and specifications; Power system protection & automation; Earthing system design and applications. By applying these engineering skills to the tasks and challenges faced in work, delegates will begin to experience breakthroughs they never thought possible.

Participants attending Electrical Engineering Advanced Workshop will develop the following competencies:

- Power system load studies, fault studies, feasibility studies, reliability, and stability
- Correct selection of substation busbar configuration to ensure flexible switching and loading
- Calculation of fault levels, propose protection settings, and demonstrate protection coordination
- Transmission lines design and operation
- Distribution system configurations and design
- Switchgear types and construction
- HV cable sizing and coefficient factors
- Earthing system calculations

PROGRAMME OBJECTIVES

Electrical Engineering Advanced Workshop aims to enable participants to achieve the following objectives:

- Model a power system by means of system parameters
- Create different load flow scenarios through different switching regimes
- How to analyze and interpret the response of the power system to different scenarios
- How to modify the power system behaviour in an area by enhancing system parameters
- Determine the location and busbar configuration of a typical substation
- Propose specifications for major substation equipment
- Create single line, layout, and schematics diagrams
- Calculate fault levels and loadings of feeders and branches
- Analyze protection logics and coordination between protection devices
- Establish communication between protection devices and controllers

WHO SHOULD ATTEND?

Electrical Engineering Advanced Workshop training course is suitable for a wide range of professionals, but will be particularly beneficial to:

- Senior / Principal Engineers
- Project Engineers / Professionals
- Intermediate Engineers
- Graduate Engineers
- Technicians and System Operators

TRAINING METHODOLOGY

- Electrical Engineering Advanced Workshop will combine presentations with interactive practical exercises, supported by video materials, activities and case studies. Delegates will be encouraged to participate actively to the particular needs of their workplace.
- Participants are encouraged to bring along with them any technical issues that they may wish to discuss during the training.

PROGRAMME SUMMARY

- Electrical Engineering Advanced Workshop covers essential skills such as Power system behaviour under steady-state conditions; Power system response to different events, disturbances, and faults; Transmission system constraints, loadability, and efficiency; Substation single line diagram, layouts, and schematics; Selection of suitable protection and automation; Selection and calculation of earthing systems.

PROGRAM OUTLINE

Power System Parameters and Response

- Important power system studies
- AC power transmission
- Power system drawings
- Power stations
- Grid network
- Smart grid
- Power transmission security
- Power distribution factors
- RLC equations
- Sinusoids & phasors
- Phasor relationships & equations
- Power types & formulas
- Single line diagram (SLD)
- Impedance model
- Power system symbols
- Voltage regulation
- Synchronous generator model
- Maximum power delivered by synchronous generator
- Reactive power flow
- Generator over-excitation
- Complex power flow on a transmission line
- Steady-state stability
- Transient stability
- Rotor angle stability

Transmission System Design Considerations

- AC transmission
- Grid network features
- Transmission security
- Building up impedance models
- Complex power definitions
- Power factor
- Power factor compensation (PFC) techniques
- Shunt reactor compensation
- Minimum clearance distances
- Line voltage drop
- Electrical loads types and behaviour
- Single wire earth return (SWER)
- Balanced 3-phase system
- Unbalanced 3-phase systems
- Symmetrical components
- Sequence networks

- Wye-connected & delta-connected loads
- Voltage regulation
- Power angle & power transfer
- Steady state stability limit
- Transmission line terms (span, sag, cross arm, clearance)
- Transmission line surge impedance and propagation
- Overhead line conductors (AAC, AAAC, ACSR)
- Bundles conductors
- Overhead line insulators
- Line supporting structure (wood & concrete poles, towers)
- Power transfer capability, current carrying capacity
- Transmission line loadability

Distribution System Design Considerations

- Load models
- Typical characteristics of an industrial distribution system
- Distribution system types and components
- Electrical safety & power security
- Voltage classification
- Multiple voltage levels in power distribution
- Distribution configurations and redundancy
- Distribution expandability
- Distribution system planning
- Electricity demand & future growth
- Equipment sizing / ratings
- HV power cables types & sizing
- Selection of appropriate equipment
- System studies & software packages
- Embedded (in-plant) generation
- Parallel operation of utility with embedded generation

Power System Protection

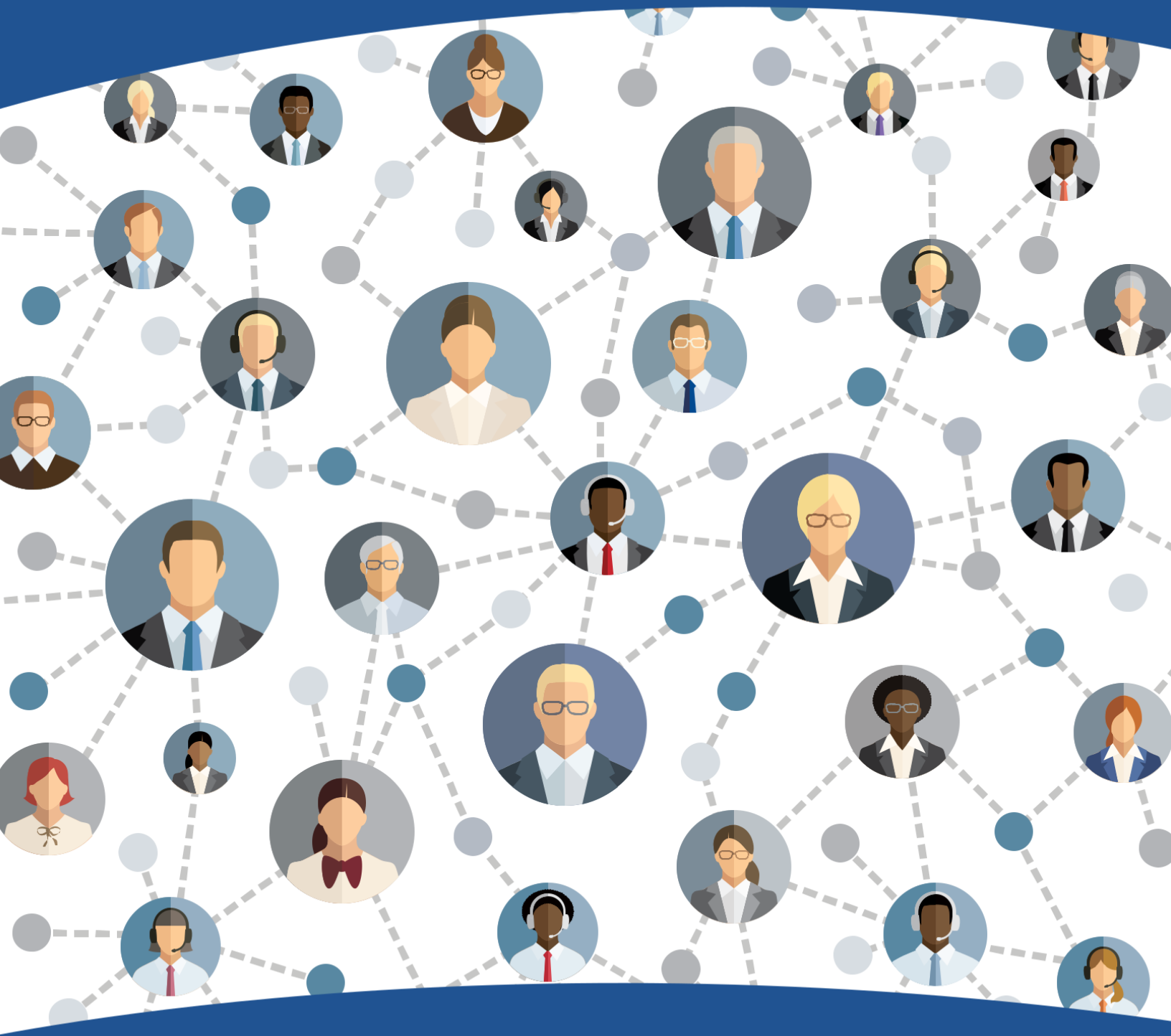
- Protection objectives
- Protection sensitivity, stability, and reliability
- Main & backup protection
- Symmetrical & asymmetrical faults
- Power system stability
- Impacts of electric faults
- Fuse protection
- Circuit breaker protection
- Relay protection (types, functions, construction, technology)
- Trip circuit supervision (TCS)
- Per Unit (PU) system
- Fault calculations
- Protection zones & overlap

- Short circuit capacity (SCC)
- Balanced 3-phase fault
- Unbalanced single-phase-to-ground fault
- Unbalanced phase-to-phase fault
- Unbalanced phase-to-phase-to-ground fault
- Fault indicator

Substation Major Equipment, Earthing and Safety

- Circuit breaker types & applications
- Switchgear types, components, and applications
- Auto-reclosers
- Sectionalizers
- Disconnect switches
- RMU's
- Earthing switches
- SF6 properties
- GIS substations
- HV cables types & calculations
- Power & distribution transformers
- Batteries & battery chargers
- Power conditioner
- Ungrounded vs. grounded systems
- Touch & step voltages, mesh voltage
- Earth potential rise (EPR), transferred voltages
- Soil resistivity
- Verification of adequacy
- Lightning protection techniques (rolling spheres, cone of protection)
- Embedded generation
- Power quality (harmonics, voltage flicker)
- Clearance distances

GULF INSTITUTE



WINNER OF THE AWARD FOR THE BEST TRAINING INSTITUTE IN THE GULF