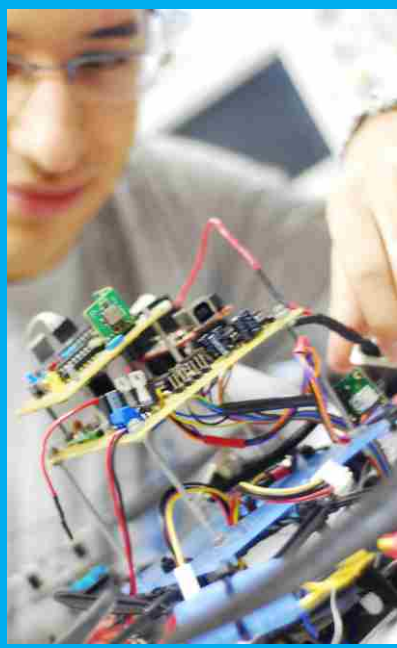


Electrical Substation & Switchyard Design



What You Will Learn...

- Select an optimised location for a substation being set up to fulfil a given set of needs
- Choose the most appropriate configuration and type of substation for this requirement
- Design a detailed layout taking into account all essential aspects
- Develop a set of conditions for which detailed system studies need to be carried out
- Design the individual subsystems for control and protection of the power system which the substation serves
- Design earthing and lightning protection systems to ensure safety of equipment and personnel in the event of abnormal system conditions such as faults and lightning events
- Design the required electrical interconnections to ensure correct functioning of the substation equipment
- Draw up a list of design inputs for building and structural design engineers

Our Strategic Objectives

To be recognized by industry and employers as a highly reputable training organization. Provide dynamic leadership, sound management and excellence in training. Continue to improve our services through quality management processes. Invest in and value our people through professional development activities. Grow our business through innovation and to continue to be financially secure. Be influential in the economic development of the industries we serve nation wise

Our Mission

“To provide quality training and assessment services and to prepare our students for a fulfilling professional career in their chosen industry. We are committed to upholding our values of providing excellence in training”

Course STRUCTURE



“I would like to thanks T&P Team of Smartbrains who helped me to get skill set on Electrical System Design. The learning experience was good and placement is excellent”

Zeeshan Ahmad
Ankit Electrotech Engineers Pvt Ltd, Noida

ROLE OF SUBSTATIONS IN AN ELECTRICAL NETWORK, TYPES AND CONFIGURATIONS OF SUBSTATIONS

- Networks-an introduction
- Different voltages in a network
- Substations as network nodes
- Substation types based on their position in the network
- Optimising the location of a substation
- Substation options: Outdoor air insulated, GIS, Indoor air insulated
- Configurations of HV substations based on their bus arrangement (typical SLD)
- Data on the industrial loads required for the design of the electrical supply substation
- Load assumptions for residential and commercial consumers
- Environmental issues in the location of a switchyard and mitigation measures

SYSTEM STUDIES REQUIRED FOR FINALISING EQUIPMENT RATINGS

- Load flow study (active/reactive loads)
- Short circuit study
- Harmonic flow
- Voltage profile and reactive power compensation
- Stability study

EARTHING SYSTEM AND LIGHTNING PROTECTION OF SWITCHYARDS

- Basics of functional and protective earthing
- Touch and step voltages in substations
- Earth grid and its role in safety
- Switchyard fence-why it should be a part of the earth grid
- Design of earth grid-basic considerations in conductor sizing and mesh spacing
- Pros and cons of including the control building within the switchyard earth grid
- Earth mat laying and welding
- Safety mesh at operating points
- Role of gravel layer in safety
- Transferred voltage hazards
- Planning isolation of outgoing services to avoid transfer voltage
- Basics of lightning and hazards
- Role of shield wire and lightning masts
- Typical configurations of lightning protection of switchyards
- Analysis of hazard using cone of protection and rolling sphere methods
- Selection of lightning arrestors-Types, class and ratings

OVERVIEW OF SWITCHYARD EQUIPMENT AND THEIR ORDERING SPECIFICATIONS

- Main (primary) equipment
 - Busbars
 - Disconnectors
 - Circuit breakers
 - Instrument transformers
 - Lightning arrestors
 - Power transformers
 - Structures
- Layout options
- Sectional and Safety clearances and their influence on the layout
- Design of busbars (strung/tubular) and interconnections between equipment
- Interconnecting cables and use of marshalling kiosks

SUBSTATION EQUIPMENT FOR FAULT LIMITING, PFC AND HARMONIC CONTROL

- Need for and application of:
 - Fault limiting reactors
 - Power factor compensation equipment
 - Static VAR compensators
 - Harmonic filters
- Equipment design and selection of ratings
- Layout of these equipment in a switchyard

PROTECTION DESIGN FOR SUBSTATION

- Brief overview of protection
- Over current protection
- Protection coordination
- Protection of transformers
- Busbar protection
- Feeder protection
- Current transformers requirements for protection
- Equipment requirements for substation automation
- PLCC applications in protection and communication
- PLCC hardware and integrating them with the switchyard equipment

SWITCHYARD CONTROL AND INTERLOCKING

- Dc power requirements for switchyard equipment
- Dc equipment configuration and specifications
- Dc distribution for switchyard equipment
- Battery calculations basis
- Space planning and related facilities for a battery installation
- Ac auxiliary power for switchyard systems-loads which require ac power
- Possible source options
- Ac auxiliary distribution for switchyard equipment and support systems
- Control scheme of disconnectors and circuit breakers
- Control interconnection approach
- Use of optical fibre-based control scheme
- Role and location of marshalling kiosks in different bays

SWITCHYARD-FACILITY PLANNING

- Site preparation, levelling
- Earth resistivity measurement and its role in design verification
- Civil works such as equipment foundations, cable trenches, control building, storm drains, transformer oil collection pit
- Structures and their design requirements
- Substation fence and physical security
- Surveillance
- Planning water requirements and supply arrangement
- Fire protection, lighting and ventilation of control room and other equipment

GAS INSULATED SWITCHGEAR (GIS) AS AN ALTERNATIVE TO OUTDOOR SWITCHYARD

- Why gas insulated substation?
- SF₆ properties, advantages and environmental impact
- Typical substation configurations in SF₆
- Indoor/outdoor options
- Gas safety considerations
- Equipment for handling SF₆
- SF₆ substation layout planning
- Cable terminations to SF₆ equipment

Why

SmartBrains?

SmartBrains is the ultimate choice for all the working & non working engineer's in energy Sector training requirements. Our extensive portfolio of energy training courses are:

- ▶ 100% focused on the Oil and energy industry.
- ▶ Guided by the industry's renowned professionals with unprecedented knowledge of the Oil and energy industry.
- ▶ Highly interactive program with practical and relevant case studies.
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Admission

Requirements

- ▶ Duly Filled Application Form
- ▶ 2 Photographs
- ▶ Photo State of Qualifying Examination
- ▶ Address Proof
- ▶ I.D. Proof
- ▶ Latest Resume



- ▶ The perfect opportunity to develop network and experiences with knowledge sharing.
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Declaration

- ▶ This training program is on AUTONOMOUS basis conducted by SmartBrains.
- ▶ SmartBrains has right to expel any student at any time for misbehavior, poor attendance without refunding the fees.
- ▶ Certification will be issued only after completion of course, submission of all assignments and passing all the examinations.
- ▶ SmartBrains has its own rules and regulations about conducting examinations and assessment of examinations

Noida Office:

H-86, Sector-63, Noida-201301
Land Mark: Behind Haldiram
Email : info@smartbrains.in
Phone: +91-120-4104991-94
+91-989 110 8700
Website: www.smartbrains.in

Hyderabad Office:

6-3- 680/403, 4 floor,
Regency House, Somajiguda,
Hyderabad - 500 082
Email : info@smartbrains.in
Phone : +91-9703751174
+91-9703132211

Vadodara Office:

9, Helix,Complex, Opp. Hotel Surya,
Sayajigunj, Vadodara - 390020
Email : info@smartbrains.in
Phone : +91-265-6595620/21
+91-9033033791/92

Pune Office:

30(1),(3), 2nd Floor, Premanjali
Complex, Opp. Ellora Palace,
Dhankawadi, Pune-411043
Email: info@smartbrains.in
Phone: +91-9860626494,
+91-9650276387