

## IPSA/APAC/GCC/CPT Course content

Sl.No	Topic	Morning session	Afternoon Session
1	Load Flow Analysis	Introduction about Power System Analysis	Introduction about Load Flow Analysis with IEEE 3002-2 and IEEE 399
2		Modelling of Bus, Grid, Transmission line, Transmission line equivalent circuit, Ferranti effect Simulation with manual calculation	surge impedance loading simulation with manual calculation, Two winding, three winding and 3-1 phase winding transformer modelling
3		Transformer paralleling, transformer losses, Transformer OLTC Selection	Power factor correction and Reactive Power Compensation
4		Control modes of generator with simulation, capability curve, Contingency analysis	Modelling and simulation of ZIP Loads, VFD, Wind Turbine Generator, Solar Inverter
5	Short Circuit Analysis	Short circuit analysis ,Types of fault, Symmetrical and Asymmetrical short circuit current, Standards, IEC 60909- Assumptions,C factor	Fault far from source and Faults near to source, Symmetrical components, Motor and Generator's contribution to short circuit calculations
6		Short circuit currents for various faults, Manual calculation, impact of Transformer Winding configuration, Significance of X/R ratio	Types of Earthing, SLG Current, Earthing Transformer, Specification requirements for Cables, CB and VT in resistance grounded Systems
7		Breaking, Making and DC Current, IEC 61363, Maximum and Minimum Fault Current	Short circuit study for grid connected systems and islanded systems
8		Real time challenges and case studies	Methods of Limiting Short Circuit Current
9	Motor Acceleration Studies	Motors, Need of Starters, Starting Torque Requirements, Static and Dynamic Motor starting study	NEMA design, Input requirements of Static and Dynamic MAS studies, Types of starters,
10		Various Motor starting methods, Star - Delta, Soft Starter, VFD, LRS	Case studies, Selection of transformer impedance, Motor starting in islanded systems
11	Relay Coordination Studies	Introduction to Protection in LV. Introduction to MCB, MCCB, ACB, Thermal Magnetic Release, Electronic Release,	LV Protection Setting calculations, Modelling of Releases, Coordination
12		MV and HV, Need of Over current and Earth Fault Protection, Protection Setting calculations of Over Current (50 & 51) and Earth Fault (50N, 51N) for transformer feeder	Protection Setting calculations of Over Current (50 & 51) and Earth Fault Relays (50N, 51N) for motor feeder
13		Protection Setting calculations of Over Current (50 & 51) and Earth Fault Relays (50N, 51N) for Bus coupler, Incomer, Tie feeder	Sensitive Earth Fault Protection, Earth fault coordination is solid & Resistance Earthed System
14		Directional Overcurrent Protection	Directional Earth fault Protection
15	Arc Flash Studies	Introduction and need of Arc Flash Studies	IEEE 1584-2018 requirements, Personal Protective Equipment's, Incident Energy, Arcing Current, Arc Flash Boundary, Different Electrode Configuration
16		NFPA 70E, PPE Selection, Manual Calculation of Incident Energy and Arcing Current, Voltage Variation	Case study, Methods to reduce incident energy, Label Creation
17	Harmonic Analysis	Introduction to Power Quality issues, Harmonic Analysis	THD,TDD,IEEE 519-Voltage and current distortion limits, Impact of Capacitor Bank on THD, Modelling of Harmonic loads (WTG, VFD, Inverters, UPS)
18		Impact of Source impedance, Needs of Filters, Passive filter design	Case studies, real time projects
19	Transient Stability Studies	Introduction to Transient Stability	Critical Clearing, Three Phase Bolted Faults, Relative Angle, Equal Area Criteria, Swing Equation, Significance of Inertia
20		SMIB System Example, Multi Machine modelling, Modelling of AVR and Governor	Grid Islanding and Load Shedding, Loss of Load, Loss of Generation
<b>Total Duration</b>			<b>80 Hours</b>