

## ADVANCED POWER SYSTEMS

### Module- I (7 Hrs)

Modeling of Transmission lines & transformers with off-nominal taps. Power flow Analysis- NR and Fast Decoupled methods

Algorithm for short circuit studies, Z Bus Formulation, Unsymmetrical fault analysis using symmetrical components

### Module- II(10 Hrs)

#### Optimal System Operation:

Generation allocation problem formulation, Loss Coefficients, Optimal load flow solution, Hydrothermal Coordination, constraints in Unit- commitment, Unit commitment solution methods.

Turbine & Generator- Load frequency Scheme, Steady state & dynamic analysis in frequency domain for single & two area system

### Module-III(16 Hrs)

#### Power Quality Problems

**Voltage Sag and over view of reliability:** Characterization of voltage sag , definition, causes of voltage sag , voltage sag magnitude , monitoring, theoretical calculation of voltage sag magnitude , voltage sag calculation in non-radial systems, meshed systems, voltage sag duration. Reliability of power systems

**PQ considerations in Industrial Power Systems:** voltage sag effects, equipment behavior of power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC drives, Adjustable speed DC drive and its operation, mitigation methods of DC drives.

**Mitigation of Interruptions and Voltage Sags:** Overview of mitigation methods- from fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods . System equipment interface- voltage source converter , series voltage controller , shunt controller , combined shunt and series controller.

### Module- IV(12 Hrs)

Power Pools & Electricity Markets: Inter-area transactions, multi-area power interchanges, Energy brokerage systems, Market design and auction mechanism, Pool versus bilateral markets and price formation, Role of independent generators and system operator

Load characteristics and load forecast: Basic definitions- load definitions, load factor definitions, diversity principle in distribution systems, Load Forecast- factors affecting load forecasting methods, small areas load forecasting, spatial load forecasting methods, simulation, trending and mixed load forecasting methods

#### **BOOKS RECOMMENDE :**

1. Stagg G.W., Eabiad A.H. "Computer methods in Power system analysis." Mc Graw Hill, 1968.
2. Nagrath & Kothari, "Modern Power System Analysis"
3. Elaerd O.Z, "Electrical Energy System Theory- An Introduction"
4. "Understanding Power Quality Problems" by Math H J Bollen, IEEE Press.
5. Electrical power quality -R C Dugan, M.F,MGranghar, H.W.Beaty-TMH.
6. A. J. Wood and B. F. Wollenberg, *Power generation, operation and control*, Wiley-Interscience, 2nd Edition, 1996.
7. K. Bhattacharya, M. H. J. Bollen and J. E. Daalder, *Operation of restructured powersystems*, Kluwer Academic Publishers, USA, 2001.