EE-403 (Power System Analysis and Control)

L-T- P : 3-1-0

Unit 1: Fault Analysis

Positive, negative and zero sequence equivalent circuits of transmission lines , Analysis of shunt faults using admittance and impedance methods of network calculation: calculation of z-bus, y-bus, Symmetrical and unsymmetrical fault calculations, Analysis of series faults.

Unit 2: Load Flow Studies, Security & State Estimation

Load Flow Studies: Formation of load flow problem, various types of buses, formation of Y- bus, various methods of load flow - Gauss Seidel, Newton Rapson method.

Power System Security and State Estimation: Security Analysis - Concept of security states, overload security analysis. Voltage Collapse - basis concept, continuation power flow. State Estimation – concept and methods of power system state estimation.

Unit 3: Economic Operation & Load Forecasting

Economic Operation of Power System: Distribution of load between the units within a plant and between the plant, Transmission-loss equation, Classical Economic Dispatch with losses. Automatic Generation Control, Unit Commitment.

Load Forecasting Techniques: Estimation of average & periodic components, system load variation & characteristics, Methods of load forecasting, time series & stochastic approach for load forecasting.

Unit 4: Excitation Systems

Elements of excitation system, DC/AC excitation systems, static excitation systems, Dynamic performance measures- Large /small signal performance measures.

Control and protective functions- AC/DC regulators, exciting system stabilizing circuit, Power system stabilizer (PSS), load compensation, under/over-excitation limiter, field shorting circuit,

Unit 5: Power, Frequency and Voltage Control

Active Power and Frequency control: control of generating unit power output, composite regulating characteristics of power systems, response rate of turbine-governing system, fundamentals of AGC.

Reactive Power and Voltage Control: Production and absorption of reactive power, methods of voltage control, shunt reactors, shunt and series capacitor, synchronous and static VAR compensator, transmission system compensation, modeling of reactive compensation devices, distribution system voltage regulation, case studies.

Text Books:

1. John J. Grainger Willian D. Stevenson, “Power System Analysis”, TMH, 2013.
2. D.P. Kothari and I.J. Nagrath, “Modern Power System Analysis”, TMH, 2012.
3. Prabha Kundur, “Power System Stability and Control”, Tata Mc Graw Hill, 2009.

Reference Books:

1. A.J.Wood, Wollenberg, “Power Generation, Operation and Control”, John Wiley, 1996.
2. C. L. Wadhwa, “Electrical Power Systems”, New age international Ltd. Third Edition
3. Ashfaq Hussain, “'Power Systems”, CBS Publishers and Distributors,2010.
4. B. R. Gupta, “Power System Analysis and Design”, Third Edition, S. Chand & Co.
5. S.N.Singh, “ Electric Power Generation, Transmission& distribution”, PHI Learning

EE-411 (Power System Lab)

L-T-P: 0-0-3

(A) Hardware Based Experiments:

1. Three Phase Symmetrical and Unsymmetrical fault Analysis (To determine fault current for L-G, L-L, L-L-G and L-L-L, L-L-L-G faults at the terminals of an alternator/transmission line at very low excitation).

2. To Study and Measurement of Direct Axis (Xd) and Quadrature Axis (Xq) Reactance by Slip Test & Study and Measurement of Positive & Negative & Zero Sequence Impedance of Three Phase Synchronous Alternator.

3. To determine Sub Transient Direct Axis Reactance (Xd'') and Sub Transient Quadrature Axis Reactance (Xq'') of an Alternator.

4. To Study the operating characteristics of Percentage Differential Relay.

5. To determine location of fault in a cable using cable fault locator

6. To Study Ferranti Effect and Voltage Distribution in H.V. long Transmission Line using Transmission Line Model.

7. To determine A, B, C, D parameters of an artificial transmission line.

8. Test for breakdown strength of a transformer oil & to study the operation of Oil testing set.

9. Study of Power Measurement using Current Transformer (CT) & Potential Transformer (PT).

10. To study Radial and Ring main Distribution system.

(B) Software Based Experiments:

Simulation Based Experiments (using MATLAB or any other related software)

11. To determine transmission line performance.
12. To obtain steady state, transient and sub-transient short circuit currents in an alternator
13. To obtain formation of Y-bus and perform load flow analysis
14. To perform symmetrical fault analysis in a power system
15. To perform unsymmetrical fault analysis in a power system
16. To Study the characteristics of Various Relays

Note: 1. At least 10 experiments should be performed out of which 3 should be simulation based.

2. Any other related equipment / Experiment for Power System-II Lab may be added as per the requirement of the syllabus.