Power System Operation and Control

Code	CreditHours
EE-862	3-0

CourseDescription

This course provides an in-depth understanding of power system operation and control, focusing on the technical, economic, and practical aspects. The course covers the interchange of power and energy, power pools, production cost models, control of generation, automatic generation control, power system security, and contingency analysis. Students will learn through lectures, practical sessions, and hands-on projects, preparing them to address real-world challenges in power system operations.

Textbook

1. Power generation, operation & Control, Allen Wood & B. Wollenberg (Latest edition)

ReferenceBook

1. Power Systems Analysis, Arthur R. Bergen, Prentice-Hall (2nd Edition)
2. Power System Analysis, John, J. Grainger & W. D. Stevenson, McGraw-Hill (Latest edition)

Prerequisites

1. Steady-state analysis of single-phase and three-phase circuits
2. Elements of transient analysis and basics electromagnetic field theory
3. Principles of electric machines, transformers, and transmission lines
4. Per-unit system and representations
5. Please also review Linear Systems for definition of a vector, a matrix, matrix sum and products, determinants, matrix inverse

ASSESSMENTSYSTEMFORTHEORY

Quizzes	10-15%
Assignments	5-10%
MidTerms	25-30%
Project	5-10%
ESE	45-50%

TeachingPlan

Week No	Topics	LearningOutcomes
1	Introduction	Overview of the course outline, objectives, teaching plan, and assessment methods.Review of key concepts in power systems.
2-3	Interchange of Power and Energy, Power Pools,	Understanding of economy interchange and inter-utility economy evaluation. Multiple utility interchange and wheeling. Analysis of load duration curves, block loading, and forced outages.
4-5	Production Cost Models, Stability constraints	Overviewing equipment and stability constraints capabilities and constraints of generators/exciters / turbines / network elements (lines, transformers etc.) constraints of energy supply systems load characteristics introduction to angle/voltage instability phenomena stability constraints
6	Control of Generation	Development and analysis of generator model, load model, prime mover model, governor model, tie line model.
7-8	Automatic Generation Control	Modelling of tie line control, area control error. Detail overview of generator allocation, base points and participation factors, primary control of frequency : governors, secondary control of frequency : AGC voltage control : automatic voltage regulators (generators), shunt compensation, svc
9	**MIDTERMEXAM**	
10-12	Power System Security	Detailed overview of security states, contingency analysis, generation shift factors, line outage factors, Detail descriptive understanding of power flow control,HVDC, facts, load curves, unit commitment Understanding the use of optimization methods, load dispatch centre functions, and contingency analysis
13-17	Contingency Selection and State Estimation	Understanding and practicing concentric relation, bounding, least square estimation and weighted least square with iterations Overview of additional topics relating to new development
18	**FINALEXAM**	