Power System Dynamics and Control - Video course

COURSE OUTLINE

This course first introduces a student to power stability problems and the basic concepts of modeling and analysis of dynamical systems.

Modeling of power system components - generators, transmission lines, excitation and prime mover controllers - is covered in detail.

Stability of single machine and multi-machine systems is analyzed using digital simulation and small-signal analysis techniques.

The impact of stability problems on power system planning, and operation is also brought out.

Contents:

Introduction to Power System Stability.

Analysis and Modeling of Dynamical Systems.

Modeling of Synchronous Machines.

Modeling of Excitation and Prime Mover Systems, Transmission Lines and Loads.

Stability Issues in Interconnected Power Systems.

Power System Stability Analysis Tools.

Enhancement of Power System Stability.

COURSE DETAIL

Sl. No	Topic	No. of Hours
1	Introduction to Power System Stability • Power System Operation and Control. • Stability Problems faced by Power Systems. • Impact on Power System Operation and Control.	3
2	Analysis of Dynamical Systems • Concept of Equilibria, Small and Large Disturbance Stability. • Example: Single Machine Infinite Bus System. • Modal Analysis of Linear Systems. • Analysis using Numerical Integration Techniques. • Issues in Modeling: Slow and Fast Transients, Stiff Systems.	8
3	Modeling of a Synchronous Machine • Physical Characteristics.	10

NP-TEL

NPTEL

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Electrical Engineering

Pre-requisites:

1. Undergraduate course in Electrical Power Systems.

Coordinators:

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	• Rotor Position Dependent model. • D-Q Transformation. • Model with Standard Parameters. • Steady State Analysis of Synchronous Machine. • Short Circuit Transient Analysis of a Synchronous Machine. • Synchronous Machine Connected to Infinite Bus.	
4	Modeling of Excitation and Prime Mover Systems • Physical Characteristics and Models. • Control system components. • Excitation System Controllers. • Prime Mover Control Systems.	4
5	Modeling of Transmission Lines and Loads • Transmission Line Physical Characteristics. • Transmission Line Modeling. • Load Models - induction machine model. • Other Subsystems - HVDC, protection systems.	4
6	Stability Issues in Interconnected Power Systems • Single Machine Infinite Bus System. • Multi-machine Systems. • Stability of Relative Motion. • Frequency Stability: Centre of Inertia Motion. • Concept of Load Sharing: Governors. • Single Machine Load Bus System: Voltage Stability. • Torsional Oscillations.	8
7	Power System Stability Analysis Tools • Transient Stability Program. • Small Signal Analysis Program. • EMTP Programs. • Real-Time Simulators.	4
8	Enhancing System Stability • Planning Measures. • Stabilizing Controllers (Power System Stabilizers). • Operational Measures- Preventive Control. • Emergency Control.	4
	Total	**45**

References:

1. K.R.Padiyar, Power System Dynamics, Stability & Control, 2nd Edition, B.S. Publications, Hyderabad, 2002.
2. P.Kundur, Power System Stability and Control, McGraw Hill Inc, New York, 1995.
3. P.Sauer & M.A.Pai, Power System Dynamics & Stability, Prentice Hall, 1997.