POWER SYSTEM CONTROL AND STABILITY

Course Code: 13EE2110 **L P C**
4 0 3

Pre requisites:

1.Student is assumed to have knowledge in synchronous machine, power system operation and control.

2.Student is assumed to have knowledge in stability of synchronous machine.

Course Outcome:

At the end of the course, the student will be able to

CO 1: Apply Park's Transformation to analyze synchronous machines and describe excitation systems.

CO 2: Explain Static VAR Compensators and simulate synchronous generator connected to infinite bus.

CO 3: Apply Routh Hurwitz Criterion to analyze single machine system.

CO 4: Design power system stabilizers and develop large power system.

CO 5: Analyze sub synchronous resonance.

UNIT-I : MODELING OF SYNCHRONOUS MACHINE:

Introduction, Synchronous Machine, Park's Transformation, Analysis of Steady State Performance. Per Unit Quantities, Equivalent Circuits of Synchronous Machine.

EXCITATION AND PRIME MOVER CONTROLLERS:

Excitation System, Excitation System Modelling, Excitation Systems-Standard Block Diagram System Representation by State Equations, Prime-Mover Control System.

UNIT-II : TRANSMISSION LINES, SVC AND LOADS :

Transmission Lines, D-Q Transformation, Static VAR compensators, Loads.

DYNAMICS OF A SYNCHRONOUS GENERATOR CONNECTED TO INFINITE BUS:

System Model, Synchronous Machine Model, Application of Model, Calculation of Initial Conditions, System Simulation, Consideration of other Machine Models.

UNIT-III : ANALYSIS OF SINGLE MACHINE SYSTEM:

Small Signal Analysis with Block Diagram Representation, Characteristic Equation (CE) and Application of Routh-Hurwitz Criterion, Synchronizing and Damping Torques Analysis, Small Signal Model: State Equations.

UNIT – IV : APPLICATION OF POWER SYSTEM STABILIZERS

Introduction, Basic concepts in applying PSS, Control Signals, Structure and tuning of PSS, Field implementation and operating experience, Examples of PSS Design and Application.

ANALYSIS OF MULTI-MACHINE SYSTEM

A Simplified System Model, Detailed Models: Case-I, Detailed Model: Case-II, Inclusion of Load and SVC Dynamics, Modal Analysis of Large Power Systems, Case Studies

UNIT-V : ANALYSIS OF SUB-SYNCHRONOUS RESONANCE:

SSR in Series Compensated Systems, Modelling of Mechanical System, Analysis of the Mechanical system, Analysis of the Combined System , Computation of *Ye(s)* : Simplified Machine Model, Computation of *Ye(s):* Detailed Machine Model, Analysis of Torsional Interaction - A Physical Reasoning, State Space Equations and Eigenvalue Analysis.

TEXT BOOKS:

1. K. R. Padiyar, "*Power System Dynamics Stability and control"*, Second Edition, B. S. Publications, 2008.

REFERENCES:

1. P.M. Anderson, A.A. Fouad, "*Power System Control and Stability*", 2nd Edition , IOWA State University Press, Galgotia Publications, 2002.
2. M.A. Pai, "*Power System Stability – Analysis by the direct method of Lyapunov*", North Holland Publishing Company, Newyork, 1981.