EE8013 POWER SYSTEMS DYNAMICS

DETAILED SYLLABUS

UNIT I INTRODUCTION

Basics of system dynamics – numerical techniques – introduction to software packages to study the responses. Concept and importance of power system stability in the operation and design - distinction between transient and dynamic stability - complexity of stability problem in large system – necessity for reduced models - stability of interconnected systems.

UNIT II SYNCHRONOUS MACHINE MODELLING

Synchronous machine - flux linkage equations - Park's transformation - per unit conversion - normalizing the equations - equivalent circuit - current space model - flux linkage state space model. Sub-transient and transient inductances - time constants. Simplified models (one axis and constant flux linkage) - steady state equations and phasor diagrams.

UNIT III MACHINE CONTROLLERS

Exciter and voltage regulators - function and types of excitation systems - typical excitation system configuration - block diagram and state space representation of IEEE type 1 excitation system - saturation function - stabilizing circuit. Function of speed governing systems - block diagram and state space representation of IEEE mechanical hydraulic governor and electrical hydraulic governors for hydro turbines and steam turbines.

UNIT IV TRANSIENT STABILITY

State equation for multi machine system with one axis model and simulation – modelling of multi machine power system with one axis machine model including excitation system and speed governing system and simulation using R-K method of fourth order (Gill's technique) for transient stability analysis - power system stabilizer. For all simulations, the algorithm and flow chart have to be discussed.

UNIT V DYNAMIC STABILITY

System response to small disturbances - linear model of the unregulated synchronous machine and its modes of oscillation - regulated synchronous machine - distribution of power impact - linearization of the load equation for the one machine problem – simplified linear model - effect of excitation on dynamic stability - approximate system representation - supplementary stabilizing signals - dynamic performance measure - small signal performance measures.

OBJECTIVES:

To impart knowledge about the following topics:

- Basics of dynamics and stability problems
- Modeling of synchronous machines
- Excitation system and speed-governing controllers.
- Small signal stability of a single-machine infinite bus system with excitation system and power system stabilizer.

- Transient stability simulation of multi machine power system.

TEXT BOOKS:

1. P.M. Anderson and A.A. Fouad, 'Power System Control and Stability', Galgotia Publications, New Delhi, 2003.

2. P. Kundur, 'Power System Stability and Control', McGraw Hill Inc., USA, 1994.

3. R. Ramanujam, "Power System Dynamics – Analysis and Simulation", PHI, 2009.

REFERENCES

1. M.A. Pai and W. Sauer, 'Power System Dynamics and Stability', Pearson Education Asia, India, 2002.

2. James A. Momoh, Mohamed. E. EI-Hawary. "Electric Systems, Dynamics and Stability with Artificial Intelligence applications", Marcel Dekker, USA First Edition, 2000.

3. C.A. Gross, "Power System Analysis," Wiley India, 2011.

4. B.M. Weedy, B.J. Lory, N. Jenkins, J.B. Ekanayake and G. Strbac," Electric Power Systems", Wiley India, 2013.

5. K. Umarao, "Computer Techniques and Models in Power System," I.K. International, 2007.