GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3730714
Semester – III
Subject Name: Power System Dynamics

Type of course: Professional Elective Course

Prerequisite: NA

Rationale: Simulation and analysis of the large power system network is very much essential to design the controllers and to investigate the system stability. In order to simulate/analyze the power system network, it is essential to obtain the dynamic models of various power system components. This subject deals with the mathematical models of various power system components and their applications for analysis and simulation of power system to investigate the system stability.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	**Introduction:** Overview of the synchronous machine models and induction machine models, Park's transformation and its significance.	04
2	**Excitation and Prime Mover Controllers:** Excitation System; Excitation System Modelling; Excitation Systems - Standard Block Diagram; System Representation by State Equations; Automatic Voltage Regulator (AVR); Prime-Mover Models and Control System.	07
3	**Transmission Line, SVC and Loads:** Transmission Line Model; D-Q Transformation using alpha-beta Variables; Static Var Compensators; Load models for analysis.	04
4	**Small signal stability analysis:** Basic Concepts of Dynamic Systems and Stability Definition, Small Signal Analysis with Block Diagram Representation and Characteristic Equation (CE); Synchronizing and Damping Torque Analysis; Small Signal Model; Linearization of non-linear system.	08

5	**Large signal Rotor Angle Stability:** Dynamic Equivalents and Coherency; Direct Method of Stability Assessment; Stability Enhancing Techniques; Oscillation damping using Power System Stabilizer; Asynchronous operation and resynchronization; Multi-machine stability	**10**
6	**Voltage and Frequency stability:** Dynamic voltage stability; Voltage collapse; Frequency Stability; Automatic Generation Control; Primary and Secondary Control; Sub-Synchronous Resonance (SSR) and Counter Measures to SSR.	**10**

Reference Books:

1. K. R. Padiyar, "Power System Dynamics Stability and Control", B S Publications
2. P. Kundur, "Power System Stability & Control", Tata Mcgraw hill
3. Paul C. Krause, Oleg Wasynczuk and Scott D. Sudhoff, "Analysis of Electric Machinery and Drive Systems", John Wiley & Sons, New York
4. P. M. Anderson & A. A. Fouad "Power System Control and Stability", Galgotia , New Delhi
5. K. R. Padiyar and Anil M Kulkarni, "Dynamics and Control of Electric Transmission and Micro-Grids", Willey-IEEE
6. J. Machowski, Bialek, Bumby, "Power System Dynamics and Stability", John Wiley & Sons
7. L. Leonard Grigsby (Ed.); "Power System Stability and Control", Second edition, CRC Press.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain the dynamic models of power system components like synchronous machine, excitation systems, loads, prime movers and SVC	25
CO-2	Analyze the power system performance in view of the small signal stability	25
CO-3	Evaluate the large disturbance rotor angle stability of the system	25
CO-4	Analyze the voltage and the frequency stability of the power system	25

Major Equipment: Simulation softwares like MATLAB, PSIM or Scilab etc

List of Open Source Software/learning website:

E-materials available at the website of NPTEL- http://nptel.ac.in/