POWER SYSTEM DYNAMICS

II Semester: EPS

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BPSB12	**Core**	3	0	0	3	30	70	100

Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil	Total Classes: 45

I. COURSEOVERVIEW:

This course will illustrate to the development of mathematical models for synchronous machine, Exciter, Governor and Prime mover. It will also cover power system dynamic phenomena and the effects of exciter and governor control. This course will also provide the idea of power system stability and help the students to understand methods to improve dynamic stability.

II.COURSE OBJECTIVES:

The course should enable the students to:

I. Development of mathematical models for synchronous machine, Exciter, Governor and Primemover.
II. Study power system dynamic phenomena and the effects of exciter and governorcontrol.
III. Understand the methods to improve dynamicstability.

III.COURSE OUTCOMES:

After successful completion of the course, students will be able to:		
CO 1	**Illustrate** the significance of power system stability and approach for analysis of multi machine system.	Understand
CO 2	**Develop** the state space equations, unit conversions, equivalent circuits for mathematical analysis of the synchronousmachines.	Apply
CO 3	**Develop** the basic components of digital relay and signal conditioning subsystems for implementation of digital protection.	Apply
CO 4	**Identify** the types of excitation and voltage control configurations to address the effects of voltage changes and reactive power.	Analyze
CO 5	**Explain** the methods to enhance the small signal stability of the power system.	Analyze

IV. SYLLABUS

UNIT-I	POWER SYSTEM STABILITY: A CLASSICAL APPROACH	Classes: 09

Introduction, requirements of a reliable electrical power service, swing equation, power-angle curve, stability analysis of SMIB system, equal area criteria, classical model of a multi-machine system, shortcomings of the classical model, block diagram of one machine, system response to small disturbances: types of problems studied, the unregulated synchronous machine, modes of oscillation of an unregulated multi-machine system, regulated synchronous machine.

UNIT-II	SYNCHRONOUS MACHINE MODELING-I	Classes: 09

Introduction, Park's Transformation, flux linkage equations, voltage equations, formulation of state- space equations, current formulation, per UNIT conversion, normalizing the voltage and torque equations, equivalent circuitofasynchronousmachine,thefluxlinkagestate-spacemodel,loadequations,sub-transientandtransient inductances and time constants, simplified models of the synchronous machine, turbine generator dynamic models.

UNIT-III	SYNCHRONOUS MACHINE MODELING-II	Classes: 10

Steady state equations and phasor diagrams, determining steady state conditions, evaluation of initial conditions, determination of machine parameters.

Digital simulation of synchronous machines, linearization and simplified linear model and state-space representation

of simplified model.		

UNIT-IV	EXCITATION AND PRIME MOVER CONTROL	Classes: 08

Simplified view of excitation control, control configurations, typical excitation configurations, excitation control system definitions, voltage regulator, exciter buildup, excitation system response, state-space description of the excitation system, computer representation of excitation systems, typical system constants, and the effects of excitation on generator power limits, transient stability and dynamic stability of the power system; Prime mover control: Hydraulic turbines and governing systems, steam turbines and governing systems.

UNIT-V	SMALL SIGNAL STABILITY ANALYSIS	Classes: 09

Fundamental concepts of stability of dynamic systems, Eigen properties of the state matrix, small-signal stability of a single-machine infinite bus system, effects of excitation system, power system stabilizer, system state matrix with amortisseurs, characteristics of small-signal stability problems.

Text Books:

1. P M Anderson & A A Fouad "Power System Control and Stability", Galgotia , New Delhi, 1st Edition,1981.
2. J Machowski, J Bialek& J R W Bumby, "Power System Dynamics and Stability", John Wiley &Sons, 1st Edition,1997.

Reference Books:

1. P Kundur, "Power System Stability and Control", McGraw Hill Inc., 1st Edition, 1994.
2. E WKimbark,"Powersystemstability",Vol.I&III,JohnWiley&Sons,NewYork1st Edition, 2002.
3. L Leonard Grigsby (Ed.); "Power System Stability and Control", CRC Press, 1st Edition,2007.

Web References:

1. https://www.scribd.com/doc/27104147/Electric-Motor-Drives-Modeling-Analysis-And-Control-2001-R-Krishnan.

E-Text Books :

1. https://www.Bimal K. Bose-Modern power electronics and AC drives -Prentice Hall PTR(2002)
2. https://www.freebookcentre.net
3. http://www.nptel.ac.in/courses/108105066/PDF/L-1(SSG)(PE)%20((EE)NPTEL).pdf