Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Technology (M. Tech)
Course Code	:	2MPS03
Course Title	:	Advanced Power System Stability
Type of Course	:	Professional Elective (PE - II)
Year of Introduction	:	2023-24

Prerequisite	:	Interconnected Power System
Course Objective	:	To understand the fundamental concepts of stability of power systems and its classification. To expose the students to dynamic behaviour of the power system for small and large disturbances. To understand and enhance the stability of power systems.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	**To Remember** knowledge about the stability of power system.
	CO2	**To Understand** knowledge on small-signal stability, transient stability and voltage stability.
	CO3	**To Understand** the dynamic behaviour of synchronous generator for different disturbances.
	CO4	**To Understand** the various methods to enhance the stability of a power system.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	SEE	CIA	SEE	CIA	
3	0	2	4	70	30	30	20	150

Legends: ***L****-Lecture;* ***T****–Tutorial/Teacher Guided Theory Practice;* ***P*** *– Practical,* ***C*** *– Credit,* ***SEE*** *– Semester End Examination,* ***CIA*** *- Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.))*

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with CO
1	**INTRODUCTION TO STABILITY:** Fundamental concepts - Stability and energy of a system - Power System Stability: Definition, Causes, Nature and Effects of disturbances, Classification of stability, Modelling of electrical components - Basic assumptions made in stability studies- Modelling of Synchronous machine for stability studies	07	15 %	CO1

	(classical model) - Rotor dynamics and the swing equation.			
2	**SMALL-SIGNAL STABILITY:** Basic concepts and definitions – State space representation, Physical Interpretation of small–signal stability, Eigen properties of the state matrix: Eigenvalues and eigenvectors, modal matrices, eigenvalue and stability, mode shape and participation factor. Small– signal stability analysis of a Single-Machine Infinite Bus (SMIB) Configuration with numerical example.	08	15 %	CO2
3	**TRANSIENT STABILITY:** Review of numerical integration methods: modified Euler and Fourth Order Runge-Kutta methods, Numerical stability, Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned – explicit approaches- Application of TSA to SMIB system.	10	25 %	CO2, CO3
4	**VOLTAGE STABILITY:** Factors affecting voltage stability- Classification of Voltage Stability-Transmission system characteristics- Generator characteristics- Load characteristics- Characteristics of reactive power compensating Devices- Voltage collapse.	10	20 %	CO2, CO3
5	**ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY:** Power System Stabilizer – Principle behind transient stability enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast-valving, high-speed excitation systems.	10	25 %	CO2, CO4

Suggested Distribution of Theory Marks Using Bloom's Taxonomy						
Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	**15**	**25**	**20**	**20**	**10**	**10**

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested List of Experiments/Tutorials

Sr. No.	Name of Experiment/Tutorial	Teaching Hours
1	Transient stability analysis of single machine-infinite bus system using classical machine model.	02
2	Contingency analysis: Generator shift factors and line outage distribution factors.	02
3	To obtain unit commitment of a power plant.	02
4	To obtain economic load dispatch of power plant.	02
5	To obtain economic load dispatch of generators considering transmission losses.	02
6	To apply analysis of various principles of Load Frequency control with the help of numerical problems.	02
7	To apply analysis of various principles of Power system angle stability with the help of numerical problems.	02
8	To determine stability of a small system using numerical method.	02
9	Find the steady state/transient stability of the system for various disturbances in power system.	02
10	Solution of swing equation using step by step method.	02

Major Equipment/ Instruments and Software Required

Sr. No.	Name of Major Equipment/ Instruments and Software
1	ETAP
2	PSCAD
3	NEPLAN

Suggested Learning Websites

Sr. No.	Name of Website
1	www.vlabs.co.in
2	www.nptel.ac.in

Reference Books

Sr. No.	Name of Reference Books
1	Peter W., Saucer, Pai M.A., "Power System Dynamics and Stability, Pearson Education (Singapore), 9th Edition, 2007.
2	EW. Kimbark., "Power System Stability", John Wiley & Sons Limited, New Jersey, 2013.

3	SB. Crary., "Power System Stability", John Wiley & Sons Limited, New Jersey, 1955.
4	Power systems dynamics: Stability and control / K.R. Padiyar, BS Publications, 2008.
5	Power system control and Stability P.M. Anderson, A.A. Foud, Iowa State University Press, 1977.