AEEE535 - Power System Stability

Course Title	Power System Stability				
Course Code	AEEE535				
Course Type	Technical Elective				
Level	MSc (Level 2)				
Year / Semester	1 or 2				
Teacher's Name	Dr Nicholas Christofides				
ECTS	8	Lectures / week	3	Laboratories / week	
Course Purpose and Objectives	The aim of the course is to familiarize students with the concepts and the principles underlying the field of Power System Stability, to provide students with deep knowledge of the theories and methodologies related to Power System Stability analysis and to enable students develop modelling skills required for investigating the response of a power system				
Learning Outcomes	By the end of the course, students must be able to: 1. Identify and explain the power system stability problem 2. Employ mathematical tools for power system stability analysis 3. Investigate and analyse small and large perturbations on a power system 4. Understand modelling techniques for investigating the response of a power system during network disturbances				
Prerequisites	None	Required	None		
Course Content	• **Introduction:** Classification of power system dynamics, reactive power and voltage, real power and frequency, stability and security of a power system • **Power System in Steady-State:** Transmission lines, Transformers, synchronous generators, power system loads, network equation, power flows • **Introduction to Power System dynamics:** Three-Phase Short-Circuit on a Synchronous Generator, Phase-to-Phase Short-Circuit Synchronization, Short Circuit in a Network and its Clearing • **Small Disturbances:** Swing Equation, Damping Power, Equilibrium Points Steady-State Stability of Unregulated System, Steady-State Stability of the Regulated System • **Large disturbances:** Transient Stability, Swings in Multi-Machine Systems, Direct Method for Stability Assessment, Synchronization, Asynchronous Operation and Resynchronization, Out-Of-Step Protection Systems, Torsional Oscillations in the Drive Shaft • **Advanced Power System Modelling:** Synchronous Generator, Excitation Systems, Turbines and Turbine Governors, FACTS Devices				

Teaching Methodology	Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration and can also be downloaded from the e-learning platform or the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours. Furthermore, design projects may be assigned to the students, where literature search is encouraged to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem, implement to implement the design and report the results in written or orally.
Bibliography	**Textbook** • Power System Dynamics: Stability and Control, 2/E, J. Machowski, J. Bialek, J.Bumby, Wiley, 2008 **References** • Electric Power Systems Essentials, Pieter Schavemaker, Lou van der Sluis, 1/E, Wiley, 2008 • Power Systems Analysis, Saadat H., McGraw Hill, 2nd Edition, 2004 • Electrical Power Systems Quality, Dugan R.C., Santoso S., McGranaghan M.F, Beaty H.W, McGraw Hill, 2nd Edition, 2003 • Power Systems Electromagnetic Transients Simulation • Arrillaga, J., Watson, N., Inspec/Iee 1/12/, 2002 • Power System Control and Stability, M. Anderson, A. Faud, IEEE Press, 2002 • Power System Stability and Control, 1/E, P. Kundur, Mcraw Hill, 1994 • Power System Analysis, Grainger J., McGraw Hill, 1994, 1st Edition
Assessment	The Students are assessed via continuous assessment throughout the duration of the Semester, which forms the Coursework grade and the final written exam. The coursework and the final exam grades are weighted 40% and 60%, respectively, and compose the final grade of the course. Various approaches are used for the continuous assessment of the students, such as mid-term written exam, oral exam, quizzes, design assignments, design projects and laboratory experiments. The assessment weight, date and time of each type of continuous assessment is being set at the beginning of the semester via the course outline. An indicative weighted continuous assessment of the course is shown below: • Assignments 10% • Homework 10% • Mid-Term written exams 40% • Design Project 30%

	• Quizzes 10% Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constrains and revision timetable. The criteria considered for the assessment of each type of the continuous assessment and the final exam of the course are: (i) the comprehension of the fundamental concepts and theory of each topic, (ii) the application of the theory in solving related problems and (iii) the ability to apply the above knowledge in more complex design problems. The above criteria are weighted 30%, 40% and 30%, respectively. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	English